Table 3.18 Environmental Issues and the Nature of Science

Percent Correct for Example Item 18 - One Way
Lower and Upper Grades (Third and Fourth Grades*)

Country	Percent Correct		Example 18
	Third Grade	Fourth Grade	Reducing air pollution.
Canada	31 (1.4)	46 (2.2)	Write down two different things that people can do to help reduce air pollution. Don't drive but walk. Put air filters on factories
Cyprus	17 (1.7)	36 (2.0)	
Czech Republic	33 (1.8)	55 (1.9)	
†‡England	36 (2.2)	52 (2.1)	
Greece	17 (1.8)	33 (2.0)	
Hong Kong	24 (1.4)	39 (1.8)	
Iceland	23 (2.3)	50 (2.7)	
Iran, Islamic Rep.	10 (1.6)	18 (1.6)	
Ireland	29 (2.2)	46 (2.0)	
Japan	41 (1.9)	57 (1.7)	
Korea	52 (2.0)	67 (2.2)	
New Zealand	28 (2.2)	41 (2.2)	
Norway	25 (2.2)	50 (2.5)	
Portugal	12 (1.5)	24 (1.8)	
†Scotland	29 (2.3)	49 (2.3)	
Singapore	28 (2.3)	44 (1.9)	
United States	45 (2.2)	59 (1.5)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	50 (2.4)	67 (1.7)	
Austria	46 (3.2)	62 (3.0)	
†Latvia (LSS)	34 (2.7)	54 (2.4)	
Netherlands	43 (2.1)	66 (2.0)	
Countries Not Meeting Age Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Slovenia	44 (2.3)	69 (2.5)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Hungary	25 (1.9)	52 (2.1)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):			
†Israel	–	38 (3.0)	
Kuwait	–	18 (1.3)	
Thailand	30 (4.2)	49 (3.0)	
International Average Percent Correct	31 (0.5)	48 (0.4)	

*Third and fourth grades in most countries. See Table 2 for information about the grades tested in each country.
†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).
‡National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
§National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (–) indicates data are not available. Israel and Kuwait did not test at the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.18 Environmental Issues and the Nature of Science (Continued)

Percent Correct for Example Item 18 - Two Ways Lower and Upper Grades (Third and Fourth Grades*)

Country	Percent Correct		Example 18
	Third Grade	Fourth Grade	Reducing air pollution
Canada	22 (1.5)	33 (2.0)	Write down two different things that people can do to help reduce air pollution.
Cyprus	10 (1.4)	25 (2.1)	Don't drive but walk
Czech Republic	19 (1.5)	38 (2.0)	Put air filters on factories
†England	21 (2.0)	35 (2.2)	
Greece	14 (1.6)	24 (1.6)	
Hong Kong	17 (1.2)	35 (2.3)	
Iceland	12 (1.7)	32 (2.7)	
Iran, Islamic Rep.	3 (0.8)	8 (1.2)	
Ireland	18 (1.3)	33 (1.8)	
Japan	30 (1.5)	44 (1.6)	
Korea	39 (2.4)	49 (2.2)	
New Zealand	17 (1.6)	31 (2.6)	
Norway	15 (1.7)	41 (2.3)	
Portugal	5 (1.0)	10 (1.3)	
†Scotland	18 (1.8)	35 (2.1)	
Singapore	21 (1.9)	37 (2.0)	
United States	37 (1.6)	48 (1.5)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	35 (2.6)	51 (1.6)	
Austria	29 (2.6)	46 (2.8)	
†Latvia (LSS)	16 (2.1)	29 (2.3)	
Netherlands	33 (2.0)	56 (2.2)	
Countries Not Meeting Age Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Slovenia	24 (1.8)	47 (2.6)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Hungary	15 (1.5)	23 (1.6)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):			
†Israel	– –	28 (2.3)	
Kuwait	– –	11 (1.1)	
Thailand	24 (3.5)	36 (2.8)	
International Average Percent Correct	21 (0.4)	34 (0.4)	

*Third and fourth grades in most countries. See Table 2 for information about the grades tested in each country.
†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).
National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (– –) indicates data are not available. Israel and Kuwait did not test at the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.19 Environmental Issues and the Nature of Science

Percent Correct for Example Item 19
Lower and Upper Grades (Third and Fourth Grades*)

Country	Percent Correct	
	Third Grade	Fourth Grade
Canada	37 (2.3)	54 (3.5)
Cyprus	22 (2.3)	29 (2.3)
Czech Republic	38 (2.7)	47 (2.8)
†²England	41 (2.9)	53 (3.0)
Greece	27 (3.0)	28 (2.5)
Hong Kong	35 (2.6)	47 (2.7)
Iceland	19 (2.5)	27 (4.2)
Iran, Islamic Rep.	19 (2.5)	21 (2.3)
Ireland	36 (2.7)	51 (2.8)
Japan	43 (2.1)	56 (2.2)
Korea	49 (2.7)	59 (3.0)
New Zealand	38 (3.4)	50 (3.5)
Norway	34 (2.7)	54 (3.0)
Portugal	25 (2.7)	32 (3.0)
†Scotland	38 (2.4)	50 (3.3)
Singapore	37 (1.8)	44 (2.0)
United States	43 (2.6)	58 (2.1)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	40 (3.0)	57 (2.2)
Austria	31 (2.9)	42 (3.6)
†Latvia (LSS)	31 (3.6)	33 (3.2)
Netherlands	38 (2.9)	53 (3.2)
Countries Not Meeting Age Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Slovenia	32 (2.9)	38 (3.1)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Hungary	34 (2.7)	44 (3.1)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
†Israel	- -	40 (3.6)
Kuwait	- -	18 (1.8)
Thailand	36 (3.5)	37 (3.4)
International Average Percent Correct	34 (0.6)	43 (0.6)

Example 19

Observations of objects in bag

Four children can feel and smell an object inside a bag, but they cannot see it. Which of the following is NOT an observation about the object?

A "It is flat at one end and round at the other."

B "It smells like peppermint."

C "It has a bump on it."

(D) "I hope it is candy."

*Third and fourth grades in most countries. See Table 2 for information about the grades tested in each country.
†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).
National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
²National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (–) indicates data are not available. Israel and Kuwait did not test at the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.20 Environmental Issues and the Nature of Science

Percent Correct for Example Item 20
Lower and Upper Grades (Third and Fourth Grades*)

Country	Percent Correct		Example 20
	Third Grade	Fourth Grade	Growing seeds in light or dark.
Canada	30 (2.2)	43 (3.1)	To find out whether seeds grow better in the light or dark, you could put some seeds on pieces of damp paper and
Cyprus	24 (2.9)	27 (2.5)	
Czech Republic	26 (2.9)	40 (2.9)	
†‡England	33 (2.4)	43 (2.5)	A keep them in a warm, dark place
Greece	21 (2.2)	30 (2.8)	B keep one group in a light place and another in a dark place
Hong Kong	25 (1.8)	36 (2.5)	C keep them in a warm, light place
Iceland	30 (2.7)	40 (3.9)	D put them in a light or dark place that is cool
Iran, Islamic Rep.	18 (2.6)	14 (2.1)	
Ireland	24 (2.3)	29 (2.4)	
Japan	- -	- -	
Korea	56 (2.9)	66 (2.7)	
New Zealand	33 (2.8)	39 (3.2)	
Norway	23 (2.7)	30 (2.5)	
Portugal	19 (2.4)	25 (2.4)	
†Scotland	32 (2.9)	36 (2.6)	
Singapore	43 (2.0)	62 (2.1)	
United States	43 (3.2)	61 (2.0)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	34 (2.3)	49 (3.1)	
Austria	19 (2.5)	35 (2.9)	
†Latvia (LSS)	24 (2.9)	23 (3.0)	
Netherlands	27 (3.1)	36 (3.2)	
Countries Not Meeting Age Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Slovenia	28 (2.7)	36 (2.5)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Hungary	21 (2.0)	19 (2.2)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):			
†Israel	- -	26 (2.4)	
Kuwait	- -	25 (1.5)	
Thailand	30 (2.8)	40 (3.0)	
International Average Percent Correct	29 (0.5)	36 (0.5)	

*Third and fourth grades in most countries. See Table 2 for information about the grades tested in each country.
†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).
‡National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
‡National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (- -) indicates data are not available. Israel and Kuwait did not test at the lower grade. Internationally comparable data are unavailable for Japan on Example 20.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.21 Environmental Issues and the Nature of Science

Percent Correct for Example Item 21
Lower and Upper Grades (Third and Fourth Grades*)

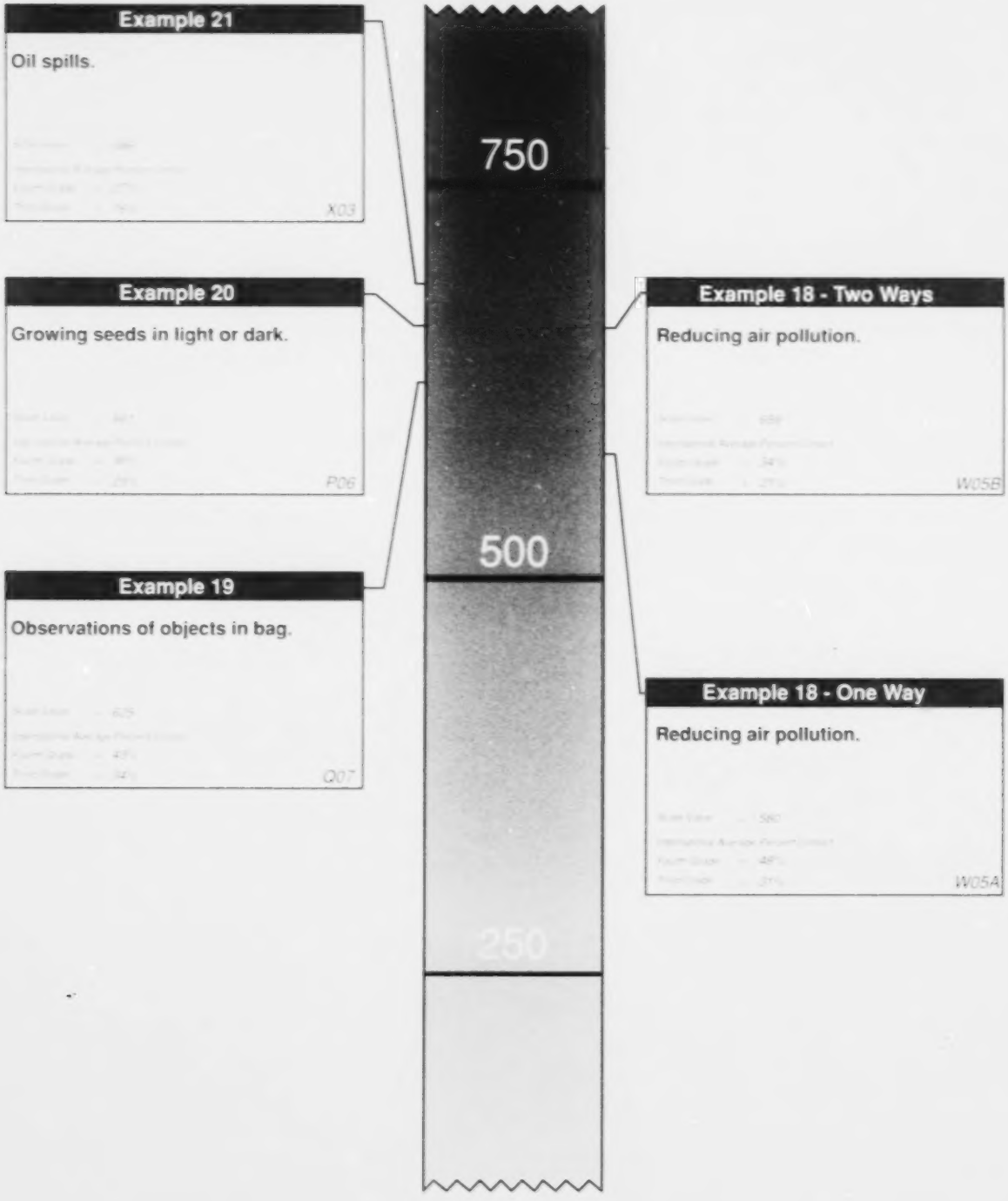
Country	Percent Correct		Example 21
	Third Grade	Fourth Grade	Oil spills.
Canada	20 (1.3)	30 (2.2)	Write as completely as possible why large oil spills in rivers and seas are harmful to the environment.
Cyprus	9 (1.3)	18 (1.6)	
Czech Republic	12 (1.4)	22 (2.0)	
†‡England	19 (1.8)	28 (2.0)	they kill the fish and make the water polluted.
Greece	14 (1.7)	25 (2.6)	
Hong Kong	3 (0.5)	9 (1.5)	
Iceland	6 (1.2)	20 (2.2)	
Iran, Islamic Rep.	3 (0.8)	7 (1.0)	
Ireland	17 (1.3)	30 (1.8)	
Japan	42 (1.8)	53 (1.7)	
Korea	51 (2.2)	64 (2.3)	
New Zealand	24 (2.1)	38 (2.2)	
Norway	10 (1.4)	21 (1.9)	
Portugal	17 (1.8)	29 (2.1)	
†Scotland	14 (1.5)	23 (1.8)	
Singapore	10 (1.4)	21 (1.7)	
United States	27 (1.8)	46 (1.3)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	23 (1.7)	37 (2.4)	
Austria	11 (1.5)	29 (2.7)	
†Latvia (LSS)	16 (2.2)	24 (2.3)	
Netherlands	10 (1.3)	20 (2.0)	
Countries Not Meeting Age Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Slovenia	12 (1.8)	21 (1.8)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Hungary	15 (1.8)	26 (1.8)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):			
†Israel	–	36 (2.3)	
Kuwait	–	11 (1.0)	
Thailand	9 (1.5)	14 (1.7)	
International Average Percent Correct	16 (0.3)	27 (0.4)	

*Third and fourth grades in most countries. See Table 2 for information about the grades tested in each country.
†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).
‡National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
†National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (–) indicates data are not available. Israel and Kuwait did not test at the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 3.4

International Difficulty Map for Environmental Issues and the Nature of Science Example Items – Lower and Upper Grades (Third and Fourth Grades*)



*Third and fourth grades in most countries; see Table 2 for information about the grades tested in each country.

NOTE: Each item was placed onto the TIMSS international science scale based on students' performance in both grades. Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

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Chapter 4

Students' Backgrounds and Attitudes Towards the Sciences

To provide an educational context for interpreting the science achievement results, TIMSS collected a full range of descriptive information from students about their backgrounds as well as their activities in and out of school. This chapter presents fourth-grade students' responses to a selected subset of these questions. In an effort to explore the degree to which the students' home and social environment fostered academic development, some of the questions presented herein address the availability of educational resources in the home. Another group of questions is provided to help examine whether or not students typically spend their out-of-school time in ways that support their in-school academic performance. Because students' attitudes and opinions about science reflect what happens in school and their perceptions of the value of science in broader social contexts, results also are described for several questions from the affective domain. Specifically, these questions asked students to express their opinions about the abilities necessary for success in science and indicate their attitudes towards the subject.

What Educational Resources Do Students Have in Their Homes?

Students specifically were asked about the availability at home of three types of educational resources – a dictionary, a study desk or table for their own use, and a computer. Table 4.1 reveals that in most countries, fourth-grade students with all three of these educational study aids had higher science achievement than students who did not have ready access to these study aids. In most countries, a high percentage (80% or more) of students reported having a dictionary in their homes. There was more variation among countries in the percentages of students reporting their own study desk or table. For the three study aids, the greatest variation was in the number of fourth-grade students reporting having a home computer. In more than one-third of the countries, the majority of students reported having a computer in the home, including the 80% or more who so reported in England, Iceland, the Netherlands, and Scotland. It is possible that these percentages include computers used for entertainment purposes, such as computer games. In most countries, however, including these four, the reports of fourth graders were quite consistent with those of their eighth-grade counterparts in TIMSS.[1]

The number of books in the home can be an indicator of a home environment that values literacy and the acquisition of knowledge, and offers general academic support. Table 4.2 presents fourth-grade students' reports about the number of books in their homes in relation to their achievement on the TIMSS science test. In most countries,

[1] Beaton, A.E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. (1996). *Science Achievement in the Middle School Years: The IEA's Third International Mathematics and Science Study (TIMSS)*. Chestnut Hill, MA: Boston College.

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Table 4.1

Students' Reports on Educational Aids in the Home: Dictionary, Study Desk/Table and Computer - Science - Upper Grade (Fourth Grade*)

Country	Have All Three Educational Aids		Do Not Have All Three Educational Aids		Have Dictionary	Have Study Desk/Table for Own Use	Have Computer
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Percent of Students	Percent of Students
Australia	50 (1.0)	578 (3.1)	50 (1.0)	547 (3.8)	78 (1.0)	93 (0.6)	63 (1.1)
Austria	50 (1.4)	565 (3.3)	50 (1.4)	565 (4.0)	95 (0.6)	82 (1.2)	61 (1.5)
Canada	41 (1.2)	574 (3.7)	59 (1.2)	532 (3.0)	85 (0.8)	78 (1.0)	52 (1.1)
Cyprus	29 (1.0)	487 (3.7)	71 (1.0)	474 (3.5)	84 (0.8)	89 (0.7)	35 (1.0)
Czech Republic	25 (1.2)	580 (4.8)	75 (1.2)	550 (2.9)	82 (1.0)	78 (0.9)	33 (1.3)
England	68 (1.3)	564 (3.5)	32 (1.3)	525 (4.3)	93 (0.6)	80 (1.0)	88 (0.9)
Greece	20 (1.0)	510 (4.5)	80 (1.0)	500 (3.7)	90 (0.9)	58 (1.0)	23 (1.1)
Hong Kong	31 (1.1)	541 (4.1)	69 (1.1)	530 (4.0)	98 (0.3)	75 (1.2)	37 (1.2)
Hungary	28 (1.4)	564 (4.3)	72 (1.4)	520 (3.3)	69 (1.3)	87 (0.8)	37 (1.4)
Iceland	60 (1.6)	517 (3.8)	40 (1.6)	492 (3.9)	79 (1.3)	92 (0.6)	81 (1.1)
Iran, Islamic Rep.	r 3 (0.5)	422 (9.4)	97 (0.5)	425 (4.1)	r 39 (2.0)	r 34 (2.1)	r 8 (0.8)
Ireland	58 (1.2)	552 (3.4)	42 (1.2)	525 (4.1)	95 (0.5)	74 (1.1)	79 (0.9)
Israel	r 67 (2.0)	512 (4.3)	33 (2.0)	499 (5.6)	r 97 (0.6)	r 95 (0.6)	r 70 (1.9)
Japan							
Korea	22 (1.0)	612 (3.2)	78 (1.0)	593 (1.9)	93 (0.6)	91 (0.7)	23 (1.0)
Kuwait	40 (1.6)	420 (3.7)	60 (1.6)	392 (3.2)	70 (1.2)	75 (1.4)	66 (1.3)
Latvia (LSS)	18 (1.2)	513 (7.2)	82 (1.2)	513 (5.4)	84 (1.0)	95 (0.6)	21 (1.3)
Netherlands	69 (1.3)	568 (3.3)	31 (1.3)	540 (4.0)	88 (0.8)	95 (0.7)	80 (1.2)
New Zealand	43 (1.3)	555 (4.1)	57 (1.3)	517 (6.2)	93 (0.7)	78 (1.4)	53 (1.5)
Norway	44 (1.4)	550 (3.7)	56 (1.4)	518 (3.8)	76 (1.2)	92 (0.8)	56 (1.3)
Portugal	26 (1.4)	502 (4.4)	74 (1.4)	474 (4.4)	89 (1.1)	64 (1.5)	34 (1.7)
Scotland	64 (1.1)	549 (4.0)	36 (1.1)	516 (4.8)	91 (0.9)	75 (1.1)	89 (0.6)
Singapore	40 (1.3)	575 (5.9)	60 (1.3)	528 (4.2)	96 (0.3)	89 (0.5)	44 (1.3)
Slovenia	36 (1.4)	561 (3.7)	64 (1.4)	538 (3.7)	82 (1.0)	87 (0.9)	43 (1.3)
Thailand	1 (0.5)	~ ~	99 (0.5)	471 (4.6)	35 (2.6)	33 (2.2)	3 (0.6)
United States	49 (1.5)	587 (3.5)	51 (1.5)	546 (3.5)	93 (0.5)	85 (0.7)	56 (1.6)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

the more books students reported in the home, the higher their science achievement. Although the main purpose of the question was to gain some information about the relative importance of academic pursuits in the students' home environments rather than to determine the actual number of books in students' homes, there was a substantial amount of variation from country to country in fourth-grade students' reports about the number of books in their homes. In Hong Kong, Iran, Kuwait, Portugal, and Thailand, 40% or more of the students reported 25 or fewer books in the home. Conversely, 40% or more of the students in Australia and Latvia (LSS) reported more than 200 books in their homes. The number of books in the home reported by fourth-grade students in most countries agreed well with the number reported by their compatriots in eighth grade,[7] although there was a tendency for fourth-grade students to report a lower number than eighth-grade students in some countries, notably Iran, Portugal, and Thailand.

Students who speak a language at home that is different from the language of the school may sometimes be at a disadvantage in learning situations, particularly in the early grades of school. Table 4.3 presents fourth-grade students' reports of the frequency with which they speak the language of the TIMSS science test at home. In almost all of the countries, with the exception of Iran, Kuwait, Singapore, and Thailand, most students reported that they always or almost always speak the language of the test at home. Most certainly, these relatively high percentages reflect the effort expended by the participating countries to test in more than one language when necessary. However, in some countries, such as Iran, Kuwait, and Thailand, testing in all possible dialects and languages was prohibitive. Interestingly, all students in Singapore were tested in English, even though for most them, English is only sometimes (71%) or never (9%) spoken in the home. In most of the countries, students tested in the language almost always spoken in the home had higher science achievement than their counterparts who reported speaking the language of the test only sometimes or never.

Table 4.4 presents information about whether students' parents were born in the country. In about half the participating countries, 80% or more of the fourth graders reported that both their parents were born in that country. In Australia, Canada, Hong Kong, Israel, New Zealand, and Singapore, 30% or more of the students reported that at least one parent not born in the country. The patterns in relation to achievement varied substantially from country to country. In several countries, there was no relationship between the number of the students' parents born in the country and science achievement (e.g., Hong Kong, Israel, and Singapore). In about one-quarter of the countries, students having both parents born in the country had the highest achievement and, in turn, those with one parent born in the country outperformed their counterparts with neither parent born in the country (e.g., Austria, Canada, Cyprus, England, Greece, and the United States).

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Table 4.2

Students' Reports on the Number of Books in the Home
Science - Upper Grade (Fourth Grade*)

Country	None or Very Few (0-10 Books)		About One Shelf (11-25 Books)		About One Bookcase (26-100 Books)		About Two Bookcases (101-200 Books)		Three or More Bookcases (More than 200 Books)	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	3 (0.4)	476 (10.2)	7 (0.4)	512 (6.3)	23 (0.7)	556 (3.2)	24 (0.6)	567 (3.9)	44 (1.0)	581 (3.0)
Austria	9 (0.8)	506 (7.0)	17 (0.9)	538 (4.9)	35 (1.7)	570 (6.1)	18 (1.2)	583 (4.5)	21 (1.5)	595 (3.7)
Canada	5 (0.6)	470 (8.7)	13 (1.0)	524 (7.8)	29 (0.9)	549 (3.5)	20 (0.6)	568 (3.5)	33 (1.3)	565 (3.2)
Cyprus	11 (0.7)	453 (5.3)	26 (1.2)	472 (3.9)	28 (1.2)	490 (4.1)	16 (0.9)	496 (4.3)	19 (1.0)	495 (4.4)
Czech Republic	2 (0.3)	~ ~	10 (0.7)	520 (5.5)	38 (1.3)	547 (3.1)	25 (1.0)	566 (3.7)	25 (1.2)	587 (5.2)
England	7 (0.6)	474 (5.8)	13 (0.9)	505 (5.7)	26 (1.0)	542 (3.8)	23 (1.0)	569 (5.0)	31 (1.2)	586 (4.1)
Greece	r 11 (1.2)	465 (7.7)	27 (1.2)	496 (4.5)	36 (1.3)	521 (2.9)	15 (1.0)	529 (8.0)	12 (0.8)	532 (8.4)
Hong Kong	23 (1.2)	511 (4.5)	27 (0.9)	530 (3.9)	28 (1.2)	550 (3.8)	11 (0.7)	548 (4.8)	11 (1.0)	548 (5.1)
Hungary	5 (0.6)	484 (9.2)	11 (0.7)	492 (5.8)	30 (1.3)	525 (3.4)	19 (0.8)	547 (4.7)	35 (1.6)	562 (3.6)
Iceland	2 (0.4)	~ ~	12 (0.9)	476 (6.7)	30 (1.1)	502 (4.8)	24 (1.3)	513 (3.9)	33 (1.0)	524 (4.6)
Iran, Islamic Rep.	54 (2.4)	405 (3.8)	24 (1.6)	440 (3.8)	11 (1.1)	442 (8.4)	3 (0.4)	450 (8.3)	7 (0.8)	454 (9.4)
Ireland	9 (0.8)	477 (6.5)	19 (1.1)	515 (4.8)	30 (0.9)	545 (4.0)	20 (1.0)	567 (4.2)	23 (1.2)	568 (4.2)
Israel	r 6 (0.6)	491 (10.1)	18 (1.5)	498 (6.3)	36 (1.2)	511 (4.4)	19 (1.2)	517 (5.8)	20 (1.3)	510 (6.4)
Japan	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Korea	11 (0.6)	558 (4.4)	11 (0.6)	572 (3.7)	32 (1.0)	595 (2.5)	25 (0.8)	608 (3.0)	22 (0.9)	620 (2.8)
Kuwait	27 (1.4)	385 (2.7)	24 (1.0)	399 (3.4)	22 (1.2)	411 (4.7)	9 (0.6)	430 (4.9)	17 (1.2)	434 (5.8)
Latvia (LSS)	4 (0.4)	461 (9.0)	8 (0.7)	491 (7.7)	25 (1.3)	518 (8.9)	21 (1.0)	525 (6.2)	42 (1.7)	524 (4.6)
Netherlands	6 (0.8)	506 (9.3)	13 (0.9)	532 (4.4)	33 (1.3)	553 (3.3)	23 (1.2)	574 (3.7)	25 (1.6)	578 (4.2)
New Zealand	7 (0.8)	438 (10.7)	9 (0.7)	476 (6.9)	22 (1.2)	532 (6.3)	23 (1.0)	554 (4.6)	39 (1.7)	558 (4.6)
Norway	3 (0.5)	469 (10.7)	10 (0.7)	486 (6.1)	27 (1.0)	522 (4.0)	23 (0.9)	540 (3.7)	37 (1.2)	555 (4.5)
Portugal	28 (1.9)	449 (5.8)	29 (1.3)	486 (3.7)	25 (1.3)	507 (3.4)	9 (0.8)	520 (4.9)	9 (1.1)	520 (6.9)
Scotland	10 (1.0)	459 (5.9)	15 (1.0)	501 (5.2)	25 (1.0)	536 (4.7)	20 (0.9)	556 (4.6)	31 (1.5)	575 (4.4)
Singapore	9 (0.6)	478 (4.0)	21 (0.9)	503 (5.1)	36 (0.8)	552 (4.0)	18 (0.8)	582 (6.0)	16 (1.1)	598 (7.4)
Slovenia	6 (0.8)	487 (10.5)	20 (1.2)	517 (4.1)	37 (1.2)	550 (3.0)	18 (0.9)	567 (4.4)	18 (1.3)	574 (5.2)
Thailand	47 (2.1)	456 (4.5)	28 (1.1)	474 (5.2)	17 (1.1)	494 (5.4)	4 (0.6)	513 (11.5)	4 (0.5)	506 (15.9)
United States	8 (0.6)	483 (5.9)	13 (0.7)	519 (4.3)	24 (0.7)	561 (3.2)	22 (0.6)	584 (3.3)	34 (1.2)	596 (3.5)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.3

Students' Reports on Frequency with Which They Speak the Language of the Test at Home - Science - Upper Grade (Fourth Grade*)

Country	Never		Sometimes		Always or Almost Always	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	1 (0.2)	~ ~	9 (0.9)	518 (7.9)	89 (1.0)	568 (2.6)
Austria	3 (0.6)	520 (15.2)	14 (1.2)	491 (7.7)	83 (1.5)	575 (4.5)
Canada	1 (0.2)	~ ~	13 (1.2)	501 (5.1)	86 (1.2)	559 (2.7)
Cyprus	3 (0.4)	449 (9.5)	9 (0.8)	477 (6.2)	88 (0.9)	480 (3.1)
Czech Republic	1 (0.2)	~ ~	3 (0.5)	533 (11.0)	96 (0.5)	558 (3.2)
England	1 (0.2)	~ ~	6 (0.8)	503 (9.9)	93 (0.8)	554 (3.6)
Greece	r 2 (0.4)	~ ~	7 (0.7)	459 (8.8)	90 (0.9)	505 (3.5)
Hong Kong	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~
Hungary	x x	x x	x x	x x	x x	x x
Iceland	1 (0.3)	~ ~	10 (0.9)	491 (8.7)	89 (1.0)	509 (3.4)
Iran, Islamic Rep.	23 (2.2)	383 (4.9)	22 (1.7)	409 (6.3)	54 (2.8)	437 (5.0)
Ireland	3 (0.3)	447 (6.5)	5 (0.6)	490 (8.8)	92 (0.8)	546 (3.2)
Israel	r 2 (0.3)	~ ~	15 (1.2)	504 (7.2)	83 (1.2)	509 (4.2)
Japan	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~
Korea	1 (0.1)	~ ~	10 (0.7)	586 (4.2)	89 (0.7)	599 (2.0)
Kuwait	13 (1.5)	402 (4.8)	37 (2.2)	412 (4.2)	50 (2.4)	398 (4.9)
Latvia (LSS)	1 (0.3)	~ ~	7 (0.8)	478 (7.9)	92 (0.8)	516 (5.1)
Netherlands	5 (0.9)	546 (7.5)	11 (1.4)	524 (8.5)	84 (1.7)	565 (2.9)
New Zealand	2 (0.2)	~ ~	11 (1.0)	461 (7.7)	87 (1.1)	544 (4.8)
Norway	r 2 (0.3)	~ ~	8 (0.9)	485 (11.0)	90 (1.0)	535 (3.4)
Portugal	r 2 (0.3)	~ ~	4 (0.5)	476 (10.1)	94 (0.5)	482 (4.0)
Scotland	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~
Singapore	9 (0.6)	486 (5.2)	71 (1.3)	538 (4.2)	20 (1.5)	607 (7.3)
Slovenia	1 (0.2)	~ ~	9 (0.9)	504 (5.4)	90 (1.0)	551 (3.6)
Thailand	11 (1.6)	439 (12.3)	29 (2.4)	464 (5.2)	60 (2.9)	482 (5.4)
United States	2 (0.2)	~ ~	13 (1.1)	513 (5.7)	85 (1.1)	576 (3.1)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates a 70-84% student response rate. An "x" indicates data available for <50% students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table 4.4

Students' Reports on Whether or Not Their Parents Were Born in the Country - Science - Upper Grade (Fourth Grade*)

Country	Neither Parent Born in Country		One Parent Born in Country		Both Parents Born in Country	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	19 (1.2)	550 (5.9)	20 (0.9)	565 (4.6)	61 (1.1)	568 (2.7)
Austria	11 (0.9)	502 (10.1)	9 (0.7)	556 (6.5)	80 (1.2)	574 (2.8)
Canada	17 (1.5)	523 (5.3)	14 (0.5)	543 (4.7)	69 (1.6)	559 (3.1)
Cyprus	3 (0.4)	444 (9.2)	11 (0.8)	468 (5.7)	85 (0.9)	480 (3.3)
Czech Republic	2 (0.3)	– –	8 (0.6)	541 (5.7)	89 (0.7)	560 (3.1)
England	9 (1.2)	517 (8.4)	15 (0.9)	545 (5.9)	76 (1.8)	560 (3.7)
Greece	5 (0.6)	453 (8.9)	10 (0.9)	483 (9.3)	85 (1.0)	506 (3.4)
Hong Kong	38 (1.8)	535 (4.4)	21 (0.9)	537 (4.2)	41 (1.8)	531 (4.1)
Hungary	2 (0.3)	– –	3 (0.3)	515 (11.8)	95 (0.4)	534 (3.4)
Iceland	1 (0.2)	– –	6 (0.6)	512 (9.9)	93 (0.7)	507 (3.3)
Iran, Islamic Rep.	5 (0.7)	421 (5.7)	4 (0.4)	400 (7.1)	91 (0.8)	424 (4.2)
Ireland	2 (0.3)	– –	10 (0.7)	532 (6.0)	88 (0.8)	541 (3.3)
Israel	32 (2.2)	504 (5.2)	24 (1.2)	507 (5.8)	44 (1.9)	510 (4.5)
Japan						
Korea	0 (0.1)	– –	1 (0.2)	– –	99 (0.2)	598 (1.8)
Kuwait	10 (0.7)	423 (8.1)	16 (0.7)	401 (3.6)	74 (1.1)	401 (3.2)
Latvia (LSS)	2 (0.3)	– –	16 (0.9)	503 (5.8)	82 (0.9)	516 (5.1)
Netherlands	8 (1.7)	500 (8.6)	6 (0.6)	552 (6.9)	86 (1.6)	565 (2.8)
New Zealand	11 (0.9)	512 (6.2)	21 (1.0)	538 (5.7)	68 (1.4)	534 (5.5)
Norway	4 (0.7)	476 (10.6)	7 (0.5)	528 (7.4)	89 (1.0)	534 (3.3)
Portugal	5 (0.6)	458 (10.8)	8 (0.6)	487 (7.1)	86 (0.9)	481 (3.9)
Scotland	9 (0.9)	564 (8.2)	19 (0.9)	540 (5.2)	72 (1.4)	533 (4.4)
Singapore	12 (0.6)	554 (5.4)	21 (0.5)	544 (5.7)	68 (0.7)	547 (5.2)
Slovenia	12 (1.2)	514 (4.3)	9 (0.6)	548 (6.2)	79 (1.4)	551 (3.7)
Thailand	2 (0.4)	–	3 (0.3)	411 (11.4)	96 (0.6)	475 (4.5)
United States	12 (1.2)	514 (6.2)	10 (0.7)	544 (5.0)	78 (1.3)	577 (3.1)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

As shown in Table 4.5, most of the students reported having been born in the country in which they were tested. The largest percentages of students reporting that they had not been born in the country (from 10% to 18%) were in Cyprus, Hong Kong, Iceland, Israel, Kuwait, the Netherlands, New Zealand, and Scotland. For about half the countries, those students born elsewhere had lower average science achievement than their classmates born in the country.

Table 4.5

Students' Reports on Whether or Not They Were Born in the Country
Science - Upper Grade (Fourth Grade*)

Country	Yes		No	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	91 (0.9)	564 (2.9)	9 (0.9)	553 (6.2)
Austria	91 (1.3)	569 (2.7)	9 (1.3)	522 (23.0)
Canada	93 (0.7)	554 (2.8)	7 (0.7)	503 (8.4)
Cyprus	88 (0.9)	477 (3.1)	12 (0.9)	477 (6.1)
Czech Republic	98 (0.2)	557 (3.1)	2 (0.2)	~ ~
England	93 (0.7)	555 (3.3)	7 (0.7)	507 (8.7)
Greece	92 (0.6)	503 (3.4)	8 (0.6)	463 (6.9)
Hong Kong	82 (2.0)	536 (3.8)	18 (2.0)	521 (5.4)
Hungary	98 (0.3)	534 (3.4)	2 (0.3)	~ ~
Iceland	87 (2.3)	506 (2.9)	13 (2.3)	508 (11.0)
Iran, Islamic Rep.	92 (0.8)	422 (4.1)	8 (0.8)	378 (4.8)
Ireland	96 (0.5)	540 (3.4)	4 (0.5)	546 (10.0)
Israel	84 (1.5)	508 (4.1)	16 (1.5)	505 (7.0)
Japan	- -	- -	- -	- -
Korea	99 (0.2)	597 (1.8)	1 (0.2)	~ ~
Kuwait	87 (1.0)	402 (3.1)	13 (1.0)	399 (6.6)
Latvia (LSS)	97 (0.5)	515 (5.0)	3 (0.5)	461 (10.3)
Netherlands	89 (0.9)	564 (3.1)	11 (0.9)	521 (6.2)
New Zealand	90 (0.7)	533 (5.0)	10 (0.7)	519 (9.2)
Norway	96 (0.5)	532 (3.4)	4 (0.5)	492 (13.9)
Portugal	94 (0.6)	483 (3.6)	6 (0.6)	445 (13.8)
Scotland	90 (0.8)	535 (4.2)	10 (0.8)	549 (8.9)
Singapore	93 (0.6)	547 (5.1)	7 (0.6)	554 (6.6)
Slovenia	96 (0.5)	548 (3.4)	4 (0.5)	499 (8.6)
Thailand	100 (0.0)	472 (4.8)	0 (0.0)	~ ~
United States	93 (0.5)	571 (3.0)	7 (0.5)	502 (6.3)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

What Are the Academic Expectations of Students, Their Families, and Their Friends?

Tables 4.6, 4.7, and 4.8 present fourth-grade students' reports about how they themselves, their mothers, and their friends feel about the importance of doing well in mathematics and science in comparison with non-academic activities. For most of the countries, from 80% to 95% of the students agreed or strongly agreed that it was important to do well in science. Countries with very high percentages of students agreeing that it was important to do well included the Czech Republic (96%), Greece (96%), Hungary (97%), Iran (97%), and the United States (97%). Only Japan, Korea, and Thailand had less than 80% of students agreeing that it was important to do well in science. Compared with science, somewhat more students agreed or strongly agreed that it was important to do well in mathematics.

For the most part, fourth-grade students indicated that their mothers' opinions about the importance of these academic activities corresponded very closely to their own feelings. In contrast, however, students reported that their friends were not in as much agreement about the importance of academic success, particularly in science.

Students' reports of their friends' opinions about the importance of doing well in science varied substantially across countries, ranging from a low of 62% in Japan to a high of 91% in Portugal. Countries where less than two-thirds of fourth graders reported that their friends agreed or strongly agreed it was important to do well in science included Israel (65%), Japan (62%), Korea (58%), and the Netherlands (54%).

Although students' friends reportedly were in general agreement about the importance of doing well in mathematics, the percentages were generally in the 70s and 80s, rather than the 90s as for the students themselves. According to students, their friends were in the lowest degree of agreement about doing well in mathematics in Korea (59%).

For purposes of comparison, fourth-grade students also were asked about the importance of two non-academic activities – having time to have fun and being good at sports. In most countries, high percentages of the students (more than 90%) felt it was important to have time to have fun. The percentages in agreement were similar to those agreeing that it was important to do well in mathematics and science in many countries. Generally, there was less agreement about the importance of being good at sports. It needs to be emphasized, however, that the relative rankings given to the four activities by students varied from country to country. Interestingly, in both Hong Kong and Singapore there was much less agreement about the importance of having time to have fun than in other countries (58% and 57%, respectively). In Hong Kong and Thailand, only about two-thirds of students reported that they think it is important to do well in sports, compared with percentages in the 80s and 90s in most other countries.

In nearly all countries, 80% or more of the fourth-grade students reported that their mothers agreed that it was important to have time to have fun. The exceptions were Greece (75%), Hong Kong (31%), Iran (76%), Korea (66%), Kuwait (71%), Singapore (46%), and Thailand (76%), where students reported from 4% to 27% lower agreement for their mothers than for themselves. According to students, their mothers give a moderate to high degree of support to the importance of being good at sports. In nearly all countries the percentages of students reporting such agreement were in the 70s, 80s, and 90s, except in Hong Kong (36%), Korea (67%), Thailand (57%), and the United States (69%).

As might be anticipated, students reported that most of their friends agreed that it was important to have fun – more than 90% in all countries except Cyprus (79%), Greece (82%), Hong Kong (65%), Iran (76%), Israel (76%), Korea (78%), Kuwait (75%), Thailand (84%), and Singapore (65%). Internationally, fourth graders reported that their friends generally were in moderate agreement that it was important to do well in sports.

Table 4.6

Students' Reports on Whether They Think It Is Important to Do Various Activities - Science - Upper Grade (Fourth Grade*)

Country	Percent of Students Responding Yes			
	Do Well in Science	Do Well in Mathematics	Have Time to Have Fun	Be Good at Sports
Australia	91 (0.8)	95 (0.4)	95 (0.4)	88 (0.6)
Austria	94 (0.6)	95 (0.6)	92 (0.7)	87 (1.1)
Canada	95 (0.5)	97 (0.3)	96 (0.5)	83 (0.7)
Cyprus	93 (0.6)	97 (0.4)	85 (1.1)	88 (1.0)
Czech Republic	96 (0.4)	96 (0.4)	94 (0.5)	88 (0.8)
England	94 (0.6)	97 (0.4)	93 (0.5)	90 (0.7)
Greece	96 (0.6)	97 (0.4)	80 (1.2)	80 (1.0)
Hong Kong	90 (0.9)	96 (0.4)	58 (1.3)	63 (1.3)
Hungary	97 (0.3)	98 (0.3)	98 (0.3)	86 (0.8)
Iceland	87 (1.6)	96 (0.5)	91 (0.8)	93 (0.7)
Iran, Islamic Rep.	97 (0.5)	96 (0.5)	r 80 (1.7)	r 91 (1.1)
Ireland	90 (0.8)	97 (0.4)	96 (0.3)	90 (0.7)
Israel	r 94 (0.6)	r 97 (0.5)	r 94 (0.8)	r 92 (0.8)
Japan	72 (0.9)	75 (0.8)	94 (0.4)	75 (0.7)
Korea	69 (1.0)	72 (1.0)	73 (1.0)	73 (1.0)
Kuwait	95 (0.5)	96 (0.5)	75 (1.2)	80 (1.3)
Latvia (LSS)	93 (0.6)	96 (0.4)	92 (0.7)	88 (1.0)
Netherlands	84 (1.2)	93 (0.7)	r 93 (0.8)	86 (1.1)
New Zealand	90 (0.7)	96 (0.5)	95 (0.7)	91 (0.6)
Norway	91 (1.0)	94 (0.6)	97 (0.4)	80 (0.9)
Portugal	94 (0.7)	94 (0.6)	90 (0.9)	89 (1.0)
Scotland	93 (0.6)	97 (0.3)	94 (0.5)	92 (0.5)
Singapore	94 (0.4)	98 (0.2)	57 (1.6)	81 (0.9)
Slovenia	94 (0.6)	94 (0.6)	89 (0.7)	92 (0.6)
Thailand	79 (1.3)	80 (1.3)	81 (1.1)	67 (1.4)
United States	97 (0.3)	98 (0.3)	94 (0.4)	82 (0.8)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.7

Students' Reports on Whether Their Mothers Think It Is Important to Do Various Activities - Science - Upper Grade (Fourth Grade*)

Country	Percent of Students Responding Yes			
	Do Well in Science	Do Well in Mathematics	Have Time to Have Fun	Be Good at Sports
Australia	91 (0.8)	96 (0.3)	92 (0.6)	82 (0.7)
Austria	93 (0.5)	96 (0.5)	88 (0.9)	74 (1.5)
Canada	95 (0.3)	98 (0.3)	92 (0.7)	74 (0.9)
Cyprus	91 (0.7)	96 (0.5)	80 (1.5)	80 (1.1)
Czech Republic	95 (0.5)	96 (0.5)	91 (0.7)	81 (0.9)
England	94 (0.6)	98 (0.3)	90 (0.8)	87 (0.9)
Greece	96 (0.4)	96 (0.5)	75 (1.4)	72 (1.3)
Hong Kong	80 (0.9)	95 (0.4)	31 (1.0)	36 (1.2)
Hungary	96 (0.4)	97 (0.4)	99 (0.2)	77 (1.0)
Iceland	88 (1.4)	98 (0.4)	83 (1.3)	90 (0.8)
Iran, Islamic Rep.	r 96 (0.6)	r 96 (0.7)	r 76 (1.7)	r 85 (1.3)
Ireland	91 (0.8)	98 (0.3)	95 (0.5)	84 (0.8)
Israel	r 93 (0.7)	r 97 (0.5)	r 88 (1.0)	r 76 (1.4)
Japan	- -	- -	- -	- -
Korea	64 (1.2)	70 (1.1)	66 (1.3)	67 (0.9)
Kuwait	94 (0.7)	94 (0.5)	71 (1.5)	71 (1.4)
Latvia (LSS)	92 (0.5)	95 (0.6)	85 (1.2)	80 (1.0)
Netherlands	78 (1.3)	92 (0.6)	85 (1.4)	72 (1.3)
New Zealand	90 (0.8)	95 (0.5)	92 (0.8)	87 (1.2)
Norway	94 (0.6)	96 (0.5)	96 (0.6)	73 (1.2)
Portugal	93 (0.8)	93 (0.6)	87 (1.0)	82 (1.1)
Scotland	93 (0.6)	98 (0.3)	93 (0.5)	87 (0.8)
Singapore	91 (0.6)	96 (0.4)	46 (1.4)	70 (1.1)
Slovenia	88 (0.9)	89 (0.8)	83 (0.9)	86 (0.9)
Thailand	79 (1.3)	79 (1.2)	76 (1.2)	57 (1.8)
United States	98 (0.2)	98 (0.2)	88 (0.8)	69 (0.8)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Data are reported as percent of students.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.8

Students' Reports on Whether Their Friends Think That It Is Important to Do Various Activities - Science - Upper Grade (Fourth Grade*)

Country	Percent of Students Responding Yes			
	Do Well in Science	Do Well in Mathematics	Have Time to Have Fun	Be Good at Sports
Australia	68 (0.9)	76 (0.8)	95 (0.4)	86 (0.5)
Austria	76 (1.6)	83 (1.4)	91 (0.8)	82 (1.2)
Canada	73 (1.0)	81 (0.8)	96 (0.4)	82 (0.7)
Cyprus	75 (1.4)	85 (0.8)	79 (1.1)	83 (0.9)
Czech Republic	85 (1.1)	88 (0.9)	93 (0.6)	84 (1.0)
England	71 (1.3)	78 (1.2)	93 (0.6)	88 (0.7)
Greece	90 (0.8)	93 (0.6)	82 (1.1)	76 (1.1)
Hong Kong	73 (1.2)	84 (1.2)	65 (1.0)	59 (1.0)
Hungary	80 (1.0)	84 (0.9)	94 (0.6)	80 (1.1)
Iceland	75 (1.9)	87 (1.0)	92 (0.9)	88 (0.9)
Iran, Islamic Rep.	87 (1.7)	r 87 (1.7)	r 76 (1.9)	r 83 (1.6)
Ireland	68 (1.6)	79 (1.2)	96 (0.4)	90 (0.6)
Israel	r 65 (1.5)	r 70 (1.5)	r 76 (1.2)	r 78 (0.9)
Japan	62 (0.9)	70 (0.7)	92 (0.4)	75 (0.7)
Korea	58 (1.0)	59 (1.1)	78 (1.1)	64 (0.9)
Kuwait	86 (1.2)	88 (1.0)	75 (1.4)	76 (1.2)
Latvia (LSS)	78 (1.2)	88 (1.0)	92 (0.6)	82 (1.2)
Netherlands	54 (2.1)	65 (2.0)	92 (0.7)	72 (1.5)
New Zealand	67 (1.3)	76 (1.2)	96 (0.6)	88 (0.9)
Norway	77 (1.4)	83 (1.3)	97 (0.5)	82 (1.0)
Portugal	91 (0.8)	91 (0.8)	93 (0.6)	88 (1.0)
Scotland	68 (1.2)	78 (1.0)	95 (0.5)	89 (0.8)
Singapore	87 (0.7)	94 (0.4)	65 (1.6)	81 (1.0)
Slovenia	86 (0.9)	89 (0.8)	90 (0.6)	91 (0.8)
Thailand	74 (1.5)	76 (1.4)	84 (1.1)	63 (1.4)
United States	69 (0.8)	72 (0.9)	95 (0.4)	83 (0.9)

*Fourth grade in most countries, see Table 2 for more information about the grades tested in each country.
Data are reported as percent of students.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

How Do Students Spend Their Out-of-School Time During the School Week?

Even though education may be thought to be the dominant activity of school-aged children, young people actually spend much more of their time outside of school. Some of this out-of-school time is spent at furthering academic development – for example, in studying or doing homework in school subjects. Table 4.9 presents fourth-grade students' reports about the amount of time they spend studying science or doing homework in science on a normal school day. Students in most countries reported spending between half an hour and an hour per day studying science. Fourth-graders in Australia, Iceland, Ireland, Japan, the Netherlands, New Zealand, Norway, and Scotland were at the lower end of the range, reporting an average of about one half hour or less per day (0.3 to 0.5 of an hour). Those in Greece, Hungary, Iran, Kuwait, Portugal, Singapore, and Slovenia reported one hour or more of science homework per day, on average, with Iran at more than two hours. More than half the students in Australia, Iceland, the Netherlands, New Zealand, Norway, and Scotland reported spending no time at all on science homework.

The relationship between time spent doing science homework and students' average science achievement was curvilinear in many countries, with the highest achievement being associated with a moderate amount of homework per day (up to one hour). This pattern suggests that, compared with their higher-achieving counterparts, the lower-performing students may do less homework, either because they do not do it or because their teachers do not assign it, or more homework, perhaps because they need to spend the extra time to keep up academically. In many countries, students doing up to one hour a day of homework had higher average science achievement than students spending no time on homework. The greatest differences were in Latvia(LSS), and Portugal. Students reporting more than one hour of homework had lower average science achievement in most countries. Only in Iran, Japan, and Korea did students reporting more than one hour of homework have average science achievement as high as those reporting less than one hour.

The students also were asked about a variety of other ways they could spend their time out of school. Fourth graders were asked about watching television, playing computer games, playing or talking with friends, doing jobs at home, playing sports, and reading books for enjoyment. Their reports about the amount of time spent daily in each of these activities are shown in Table 4.10. Granted, some television programming and some computer games are targeted at developing children's academic abilities, and leisure reading also can be related to higher academic achievement. Still, much fare on television is not educationally related, and fourth-grade students in many countries reported spending nearly as much time each day watching television – an average of about two hours per day – as they did doing homework. Fourth graders in many countries also appear to spend about two hours per day playing or talking with friends, and nearly two hours playing sports. The time spent on leisure activities is not additive, because students often do these activities

Table 4.9

Students' Reports on the Amount of Out-of-School Time Spent Studying Science or Doing Science Homework on a Normal School Day
Science - Upper Grade (Fourth Grade*)

Country	No Time		Less than 1 Hour		1 Hour or More		Average Hours[1]
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	
Australia	55 (1.3)	566 (3.3)	33 (1.3)	570 (3.5)	12 (0.8)	536 (7.1)	0.4 (0.02)
Austria	11 (1.8)	563 (6.7)	56 (1.8)	573 (4.4)	33 (1.7)	553 (4.1)	0.9 (0.03)
Canada	38 (1.7)	552 (3.7)	46 (1.3)	559 (3.6)	16 (1.1)	533 (4.9)	0.6 (0.03)
Cyprus	21 (1.2)	469 (4.9)	51 (1.9)	489 (3.4)	28 (1.5)	466 (3.7)	0.8 (0.03)
Czech Republic	15 (0.9)	555 (5.6)	68 (1.2)	562 (3.3)	17 (1.0)	549 (3.8)	0.6 (0.02)
England	- -	- -	- -	- -	- -	- -	- -
Greece	8 (0.9)	475 (13.5)	46 (1.6)	510 (3.7)	47 (1.5)	499 (3.3)	1.3 (0.03)
Hong Kong	9 (1.0)	506 (4.9)	63 (1.7)	542 (3.5)	28 (1.1)	524 (4.7)	0.9 (0.02)
Hungary	10 (0.8)	504 (6.0)	51 (1.3)	543 (3.9)	39 (1.4)	529 (3.6)	1.0 (0.03)
Iceland	61 (2.0)	513 (4.3)	30 (1.6)	507 (4.9)	9 (0.8)	484 (9.1)	0.3 (0.02)
Iran, Islamic Rep.	5 (0.7)	392 (7.9)	23 (1.5)	430 (7.3)	72 (1.5)	429 (4.2)	2.1 (0.06)
Ireland	46 (2.1)	544 (3.5)	45 (2.0)	552 (4.3)	9 (0.6)	490 (5.8)	0.4 (0.02)
Israel	r 23 (1.6)	507 (5.4)	47 (1.9)	515 (5.3)	30 (1.9)	492 (4.7)	r 0.9 (0.04)
Japan	41 (1.8)	566 (2.3)	48 (1.5)	580 (2.0)	11 (0.6)	584 (3.4)	0.4 (0.02)
Korea	26 (0.9)	589 (3.6)	46 (0.9)	600 (2.4)	28 (1.0)	604 (2.8)	0.8 (0.02)
Kuwait	6 (0.9)	376 (9.8)	38 (1.3)	414 (3.3)	57 (1.4)	400 (3.8)	1.8 (0.05)
Latvia (LSS)	11 (1.0)	487 (6.5)	69 (1.6)	529 (6.1)	20 (1.3)	496 (5.8)	0.8 (0.03)
Netherlands	r 56 (3.3)	563 (3.5)	34 (2.7)	563 (4.2)	10 (1.3)	535 (6.0)	r 0.4 (0.03)
New Zealand	55 (1.7)	534 (6.5)	32 (1.6)	546 (5.2)	13 (0.9)	511 (6.9)	0.5 (0.02)
Norway	51 (1.8)	535 (3.7)	41 (1.7)	540 (4.6)	8 (0.8)	523 (7.4)	0.4 (0.02)
Portugal	4 (0.5)	428 (13.2)	53 (1.7)	493 (4.3)	43 (1.6)	475 (4.2)	1.3 (0.03)
Scotland	62 (1.8)	541 (4.8)	31 (1.8)	540 (4.8)	7 (0.7)	494 (10.3)	0.3 (0.02)
Singapore	- -	- -	- -	- -	- -	- -	- -
Slovenia	4 (0.6)	510 (12.6)	56 (1.5)	553 (3.2)	40 (1.6)	545 (4.0)	1.0 (0.03)
Thailand	46 (1.9)	480 (4.1)	29 (1.3)	471 (5.7)	24 (1.6)	458 (8.2)	0.7 (0.03)
United States	23 (1.2)	558 (4.1)	54 (1.2)	582 (3.3)	24 (1.2)	542 (3.4)	0.8 (0.02)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
[1] Average hours based on: No time = 0; Less than 1 hour = .5; 1-2 hours = 1.5; 3-4 hours = 3.5; More than 4 hours = 5.
Modified response categories for Israel and Latvia: 3-5 hours = 4; More than 5 hours = 7.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.10

Students' Reports on How They Spend Their Leisure Time on a Normal School Day[1] - Science - Upper Grade (Fourth Grade*)

Country	Average Hours Watching Television or Videos	Average Hours Playing Computer Games	Average Hours Playing or Talking with Friends	Average Hours Doing Jobs at Home	Average Hours Playing Sports	Average Hours Reading a Book for Enjoyment
Australia	2.0 (0.05)	0.8 (0.02)	1.2 (0.03)	1.1 (0.02)	1.6 (0.03)	0.9 (0.02)
Austria	1.4 (0.04)	0.7 (0.03)	2.9 (0.06)	1.0 (0.04)	1.9 (0.05)	1.3 (0.05)
Canada	1.9 (0.04)	0.6 (0.02)	1.5 (0.04)	1.1 (0.03)	1.8 (0.03)	1.1 (0.03)
Cyprus	1.8 (0.05)	0.6 (0.03)	1.6 (0.05)	1.4 (0.04)	0.9 (0.04)	1.3 (0.04)
Czech Republic	1.7 (0.04)	0.6 (0.03)	2.4 (0.05)	1.2 (0.03)	1.6 (0.04)	1.0 (0.02)
England	2.2 (0.04)	1.2 (0.04)	1.5 (0.04)	0.9 (0.03)	1.7 (0.04)	1.0 (0.03)
Greece	1.3 (0.04)	0.7 (0.03)	1.2 (0.03)	1.3 (0.04)	1.8 (0.04)	1.6 (0.05)
Hong Kong	1.5 (0.04)	0.6 (0.03)	0.7 (0.03)	0.9 (0.02)	0.8 (0.02)	1.0 (0.02)
Hungary	2.3 (0.05)	0.9 (0.03)	1.9 (0.04)	1.8 (0.05)	1.7 (0.03)	1.3 (0.04)
Iceland	1.2 (0.04)	0.7 (0.03)	1.5 (0.06)	0.8 (0.04)	1.3 (0.04)	1.0 (0.03)
Iran, Islamic Rep.	r 1.3 (0.05)	0.3 (0.03)	r 1.1 (0.04)	r 1.7 (0.06)	r 1.2 (0.04)	r 1.3 (0.06)
Ireland	1.9 (0.05)	0.9 (0.04)	1.1 (0.04)	1.1 (0.03)	1.8 (0.04)	1.1 (0.03)
Israel	r 2.5 (0.06)	r 1.1 (0.07)	r 1.8 (0.07)	r 1.3 (0.04)	r 2.1 (0.07)	r 1.4 (0.06)
Japan	1.9 (0.03)	0.8 (0.02)	1.4 (0.03)	0.8 (0.02)	1.3 (0.03)	0.9 (0.02)
Korea	1.5 (0.03)	0.3 (0.02)	1.0 (0.03)	0.7 (0.02)	0.7 (0.02)	1.0 (0.02)
Kuwait	1.4 (0.03)	1.1 (0.04)	1.0 (0.03)	1.4 (0.05)	1.7 (0.04)	1.3 (0.03)
Latvia (LSS)	2.3 (0.07)	r 0.8 (0.06)	1.9 (0.06)	1.3 (0.05)	1.2 (0.05)	1.3 (0.05)
Netherlands	1.7 (0.06)	0.9 (0.03)	3.0 (0.06)	0.9 (0.03)	1.6 (0.05)	0.9 (0.03)
New Zealand	2.0 (0.06)	0.9 (0.04)	1.3 (0.04)	1.0 (0.03)	1.5 (0.04)	1.0 (0.03)
Norway	1.7 (0.04)	0.7 (0.03)	2.9 (0.05)	1.0 (0.03)	1.5 (0.04)	0.8 (0.03)
Portugal	1.5 (0.05)	0.7 (0.04)	1.2 (0.04)	0.9 (0.03)	1.4 (0.05)	1.1 (0.03)
Scotland	1.9 (0.06)	1.0 (0.04)	1.6 (0.05)	0.9 (0.03)	1.9 (0.04)	1.0 (0.03)
Singapore	- -	- -	- -	- -	- -	- -
Slovenia	1.5 (0.04)	0.7 (0.03)	1.2 (0.04)	1.7 (0.05)	1.8 (0.04)	1.3 (0.03)
Thailand	1.1 (0.09)	0.2 (0.02)	1.0 (0.06)	1.2 (0.03)	1.0 (0.03)	0.9 (0.03)
United States	2.0 (0.04)	0.8 (0.03)	1.5 (0.04)	1.2 (0.02)	2.0 (0.03)	1.2 (0.03)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Average hours based on: No time = 0; Less than 1 hour = .5; 1-2 hours = 1.5; 3-4 hours = 3.5; More than 4 hours = 5.
Modified response categories for Israel and Latvia: 3-5 hours = 4; More than 5 hours = 7.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

simultaneously (e.g., talk with friends and watch television). Nevertheless, it does appear that in most countries at least as much time is spent on some of these largely non-academic activities as on studying and doing science homework.

The relationship between science achievement and amount of time spent watching television on a normal school day was similar across countries to that between achievement and time spent doing homework (see Table 4.11). In more than half the TIMSS countries, the highest science achievement was associated with watching from one to two hours of television per day. This was the most common response, reflecting from 23% to 46% of the students for all countries. That watching less than one hour of television per day generally was associated with lower average science achievement than watching one to two hours in many countries most likely has little to do with the influence of television viewing on science achievement. For these students, low television viewing may be a surrogate socio-economic indicator, suggesting something about children's access to television sets across countries. Because students with fewer socio-economic advantages generally perform less well than their counterparts academically, it may be that students who reported less than one hour watching television each day simply do not have television sets in their homes, or come from homes with only one television set where they have less opportunity to spend a lot of time watching their choice of programming.

In general, beyond one to two hours of television viewing per day, the more television fourth graders reported watching, the lower their science achievement, although there were several countries where students watching three to four hours of television did not have lower achievement than those watching one to two hours. In most countries, however, students watching more than four hours of television per day had the lowest average science achievement. In more than half of the countries, 10% or more of the students reported watching more than four hours of television each day. The countries with the highest percentages of such students included Australia (15%), England (18%), Hungary (20%), New Zealand (19%), and the United States (17%).

Table 4.11

Students' Reports on the Hours Spent Watching Television and Videos on a Normal School Day - Science - Upper Grade (Fourth Grade*)

Country	Less than 1 Hour		1 to 2 Hours		3 to 4 Hours		More than 4 Hours	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	32 (1.0)	565 (4.4)	36 (0.8)	572 (2.7)	17 (0.7)	565 (2.9)	15 (1.0)	536 (6.3)
Austria	41 (1.7)	559 (3.5)	43 (1.7)	574 (5.1)	9 (0.8)	574 (5.6)	7 (0.7)	531 (8.7)
Canada	36 (1.0)	554 (4.4)	37 (0.9)	559 (2.9)	14 (0.7)	546 (4.3)	13 (0.9)	529 (4.8)
Cyprus	34 (1.7)	476 (4.0)	41 (1.4)	481 (3.8)	15 (0.9)	478 (4.3)	10 (0.8)	470 (4.9)
Czech Republic	32 (1.4)	551 (4.2)	44 (1.3)	565 (3.6)	15 (0.8)	560 (3.8)	9 (0.8)	549 (5.0)
England	28 (1.3)	544 (4.6)	38 (1.0)	570 (4.1)	16 (0.9)	571 (4.8)	18 (0.9)	533 (4.8)
Greece	53 (1.4)	501 (3.7)	32 (1.5)	511 (3.9)	8 (0.7)	496 (8.6)	7 (0.6)	472 (10.9)
Hong Kong	48 (1.4)	531 (3.5)	31 (0.9)	543 (3.8)	12 (0.7)	537 (5.1)	9 (0.6)	510 (9.1)
Hungary	21 (1.2)	541 (4.9)	42 (1.2)	542 (3.4)	17 (0.8)	534 (4.7)	20 (1.2)	504 (4.8)
Iceland	53 (1.6)	510 (4.5)	33 (1.4)	510 (4.3)	9 (0.8)	489 (8.2)	5 (0.6)	486 (7.9)
Iran, Islamic Rep. r	52 (2.1)	414 (4.4)	35 (1.7)	440 (5.8)	7 (0.7)	433 (6.4)	6 (0.7)	433 (8.7)
Ireland	33 (1.3)	529 (3.9)	37 (1.1)	550 (4.2)	16 (1.0)	556 (4.6)	14 (0.9)	529 (5.7)
Israel r	23 (1.3)	504 (5.6)	40 (1.3)	509 (4.3)	25 (1.2)	506 (5.8)	12 (0.9)	501 (7.9)
Japan	33 (0.8)	561 (2.0)	36 (0.9)	584 (2.5)	20 (0.6)	579 (3.0)	11 (0.6)	580 (4.3)
Korea	43 (1.0)	592 (2.5)	35 (0.9)	605 (2.4)	16 (0.8)	602 (3.6)	7 (0.5)	590 (5.8)
Kuwait	59 (1.1)	404 (3.0)	23 (1.0)	409 (3.7)	9 (0.5)	397 (4.7)	10 (0.5)	388 (6.5)
Latvia (LSS)	32 (1.3)	502 (5.9)	37 (1.5)	536 (7.3)	19 (1.1)	522 (6.6)	12 (1.0)	486 (6.2)
Netherlands	36 (1.4)	556 (4.2)	39 (1.2)	562 (4.1)	15 (0.9)	572 (3.4)	9 (1.0)	536 (4.8)
New Zealand	36 (1.5)	538 (6.3)	31 (1.4)	554 (4.6)	15 (0.9)	537 (8.6)	19 (1.2)	487 (8.3)
Norway	33 (1.4)	523 (4.8)	46 (1.3)	538 (3.8)	14 (0.8)	555 (6.0)	8 (0.7)	528 (7.1)
Portugal	48 (1.8)	478 (4.7)	35 (1.5)	490 (4.0)	9 (0.7)	486 (8.2)	9 (0.9)	467 (6.5)
Scotland	37 (1.3)	535 (4.8)	36 (1.1)	546 (4.7)	13 (0.7)	543 (6.6)	14 (1.2)	515 (6.1)
Singapore	- -	- -	- -	- -	- -	- -	- -	- -
Slovenia	41 (1.6)	541 (4.3)	40 (1.3)	552 (3.5)	12 (0.9)	557 (5.9)	6 (0.7)	541 (7.3)
Thailand	65 (2.2)	470 (4.6)	23 (1.3)	483 (5.8)	5 (0.6)	483 (8.2)	6 (1.7)	445 (10.4)
United States	32 (0.9)	565 (3.9)	36 (0.7)	580 (3.9)	15 (0.8)	580 (3.8)	17 (0.7)	531 (3.8)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Modified response categories for Israel and Latvia: 3-5 hours; More than 5 hours.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

How Do Students Perceive Success in Science?

Table 4.12 presents fourth-grade students' perceptions about doing well in science. In every country the majority of students agreed or strongly agreed that they did well in science, and these perceptions were supported by the science achievement results: those who agreed that they usually do well performed better, on average, than those who disagreed. Interestingly, in several countries, notably New Zealand, Norway, and Scotland, the fourth graders who strongly agreed that they usually do well had lower average achievement than those who merely agreed.

Figure 4.1 indicates that in all countries, both boys and girls agreed that they did well in the sciences – a perception that did not always coincide with their achievement on the TIMSS science test. Only in Ireland was there a significant difference between boys and girls, with girls having higher perceptions of success than boys. It is interesting that the lower self-perceptions reported by eighth-grade girls' in England, Hong Kong, Japan, New Zealand, Norway, Scotland, and Singapore about doing well in science were not in evidence among their fourth-grade compatriots.

Students were asked about the necessity of various attributes or activities for doing well in science (see Table 4.13). There was considerable variation from country to country in the percentage of fourth-grade students agreeing that natural talent or ability were important to doing well in science, although the majority of students in every country were in agreement. The percentage agreeing ranged from 57% in the Czech republic to 90% or more in Hungary, Iran, Korea, and Kuwait. Internationally, relatively fewer students agreed that good luck was important to doing well, although the majority were of that opinion in more than half of the countries. The countries where more than 70% of the fourth-graders agreed that good luck was needed to do well in science included Hungary, Iran, Kuwait, and Latvia (LSS).

Internationally, there was a high degree of agreement among students that a lot of hard work studying at home was necessary in order to do well in science. Percentages of agreement were in the 80s and 90s for most countries and in the 70s for the Netherlands and Thailand. The variation was substantial from country to country regarding students' agreement with the need to memorize the textbook or notes. In Iceland, Iran, Japan, and Kuwait, 90% or more of the fourth-grade students agreed or strongly agreed that memorization was important to doing well in science. In contrast, fewer than 50% agreed in the Netherlands.

Table 4.12

Students' Reports on Their Self-Perceptions About Usually Doing Well in the Sciences - Upper Grade (Fourth Grade*)

Country	Strongly Disagree		Disagree		Agree		Strongly Agree	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	4 (0.4)	503 (10.0)	11 (0.8)	531 (6.4)	63 (1.0)	571 (2.5)	22 (0.9)	578 (4.6)
Austria	2 (0.4)	~ ~	12 (1.1)	520 (6.3)	36 (1.3)	554 (3.9)	49 (1.8)	587 (4.5)
Canada	3 (0.4)	499 (8.5)	10 (0.6)	514 (5.2)	59 (1.3)	554 (3.3)	29 (1.2)	564 (5.2)
Cyprus	2 (0.3)	~ ~	6 (0.6)	456 (8.9)	42 (1.3)	481 (4.0)	51 (1.5)	482 (3.1)
Czech Republic	3 (0.3)	490 (8.0)	16 (1.0)	517 (4.6)	55 (1.1)	563 (3.4)	27 (1.0)	578 (4.3)
England	5 (0.5)	497 (7.5)	13 (0.7)	536 (5.2)	61 (1.0)	563 (3.7)	21 (0.9)	553 (4.8)
Greece	1 (0.2)	~ ~	4 (0.5)	458 (12.3)	35 (1.4)	500 (3.8)	60 (1.4)	507 (3.6)
Hong Kong	3 (0.3)	457 (11.0)	13 (0.8)	512 (5.9)	55 (1.0)	537 (3.3)	29 (1.3)	545 (4.7)
Hungary	2 (0.2)	~ ~	12 (0.8)	496 (5.3)	54 (1.3)	532 (3.5)	33 (1.3)	549 (4.3)
Iceland	9 (1.4)	503 (8.1)	11 (1.1)	492 (6.5)	50 (1.4)	515 (4.6)	30 (1.6)	505 (4.7)
Iran, Islamic Rep. r	2 (0.3)	~ ~	3 (0.4)	384 (8.4)	36 (1.8)	424 (5.2)	60 (1.8)	426 (4.5)
Ireland	7 (0.7)	507 (7.7)	10 (0.8)	520 (5.1)	58 (1.3)	548 (3.1)	25 (1.3)	544 (5.4)
Israel r	3 (0.4)	470 (12.1)	7 (0.7)	501 (9.4)	39 (1.7)	512 (4.1)	51 (1.8)	509 (4.6)
Japan	2 (0.2)	~ ~	21 (0.8)	541 (2.5)	67 (0.9)	579 (1.8)	11 (0.7)	619 (3.5)
Korea	- -	- -	- -	- -	- -	- -	- -	- -
Kuwait	5 (0.6)	400 (8.5)	8 (0.6)	378 (5.3)	36 (1.0)	399 (2.7)	52 (1.4)	412 (3.4)
Latvia (LSS)	2 (0.4)	~ ~	20 (1.3)	504 (9.1)	53 (1.5)	521 (5.0)	24 (1.6)	513 (6.0)
Netherlands	3 (0.4)	527 (10.9)	15 (0.8)	545 (5.9)	62 (1.1)	560 (3.5)	20 (1.2)	573 (4.7)
New Zealand	6 (0.7)	492 (9.8)	13 (0.9)	511 (6.7)	57 (1.3)	547 (4.0)	24 (1.3)	526 (9.9)
Norway	4 (0.5)	506 (10.5)	11 (0.8)	525 (6.3)	58 (1.5)	542 (3.4)	27 (1.6)	527 (5.2)
Portugal	3 (0.5)	421 (10.0)	9 (0.8)	453 (7.6)	53 (1.2)	490 (4.0)	35 (1.3)	486 (5.0)
Scotland	5 (0.5)	505 (9.9)	14 (0.7)	523 (6.0)	63 (1.2)	549 (3.9)	18 (1.0)	525 (6.7)
Singapore	4 (0.4)	460 (7.5)	25 (1.0)	528 (6.2)	58 (1.0)	562 (5.0)	13 (0.7)	568 (6.5)
Slovenia	1 (0.3)	~ ~	12 (0.7)	514 (4.1)	53 (1.3)	544 (3.5)	33 (1.3)	566 (5.0)
Thailand	5 (0.6)	442 (9.5)	22 (1.1)	465 (4.6)	43 (1.5)	483 (5.4)	29 (1.3)	466 (6.0)
United States	2 (0.2)	~ ~	7 (0.5)	512 (5.2)	52 (0.9)	565 (2.7)	39 (0.9)	585 (4.0)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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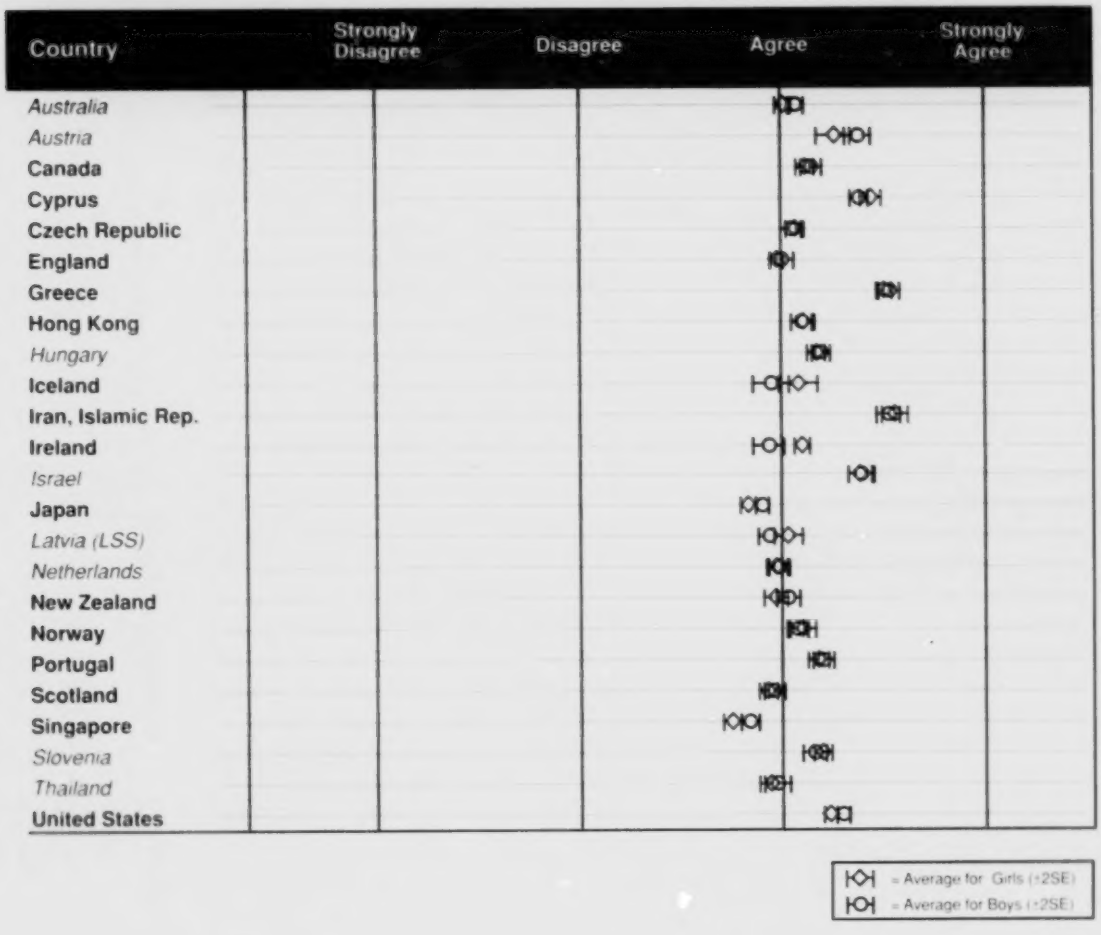
Figure 4.1

Gender Differences in Students' Self-Perceptions About Usually Doing Well in the Sciences - Upper Grade (Fourth Grade*)



*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Data for Korea are not available.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.13

Students' Reports on Things Necessary to Do Well in the Sciences Upper Grade (Fourth Grade*)

Country	Percent of Students Responding Agree or Strongly Agree			
	Natural Talent/Ability	Good Luck	Lots of Hard Work Studying at Home	Memorize the Textbook or Notes
Australia	84 (0.8)	59 (1.3)	82 (0.9)	67 (1.1)
Austria	72 (1.9)	54 (1.7)	84 (1.3)	69 (1.8)
Canada	82 (0.8)	50 (1.4)	89 (0.7)	64 (1.3)
Cyprus	69 (1.8)	58 (2.3)	96 (0.4)	75 (1.8)
Czech Republic	57 (1.6)	65 (1.4)	87 (0.7)	68 (1.6)
England	- -	- -	- -	- -
Greece	63 (1.3)	46 (1.5)	87 (0.9)	74 (1.7)
Hong Kong	72 (1.2)	19 (0.8)	96 (0.3)	69 (2.1)
Hungary	95 (0.4)	75 (1.1)	89 (0.7)	85 (0.9)
Iceland	78 (1.4)	61 (1.6)	88 (1.2)	90 (1.0)
Iran, Islamic Rep.	r 96 (0.5)	r 75 (2.4)	r 93 (0.6)	r 90 (1.0)
Ireland	87 (0.9)	65 (1.4)	89 (0.8)	74 (1.4)
Israel	r 69 (1.6)	r 44 (1.8)	r 96 (0.5)	r 67 (1.6)
Japan	79 (0.9)	53 (1.2)	88 (0.6)	93 (0.5)
Korea	90 (0.6)	61 (1.0)	94 (0.5)	84 (0.8)
Kuwait	92 (0.5)	78 (1.4)	88 (0.8)	90 (0.8)
Latvia (LSS)	75 (1.7)	84 (1.3)	91 (0.9)	61 (2.2)
Netherlands	65 (1.6)	r 28 (1.8)	r 73 (1.8)	r 30 (2.3)
New Zealand	84 (1.1)	65 (1.3)	86 (1.0)	72 (1.4)
Norway	93 (0.6)	59 (1.6)	88 (0.9)	82 (1.0)
Portugal	85 (1.3)	67 (2.1)	96 (0.4)	85 (1.1)
Scotland	- -	- -	- -	- -
Singapore	88 (0.8)	37 (1.5)	94 (0.4)	76 (1.2)
Slovenia	81 (1.5)	62 (2.1)	93 (0.7)	52 (2.0)
Thailand	77 (1.3)	63 (1.7)	70 (1.9)	87 (1.0)
United States	62 (1.0)	46 (1.2)	93 (0.3)	71 (1.0)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

What Are Students' Attitudes Towards Science?

To collect information on fourth-grade students' perceptions of science, TIMSS asked them a series of questions about the importance and enjoyability of science and science subject areas. Students' perceptions about the value of learning the sciences may be considered as both an input and outcome variable, because their attitudes towards science subjects can be related to educational achievement in ways that reinforce higher or lower performance. That is, students who do well in the sciences generally have more positive attitudes towards the science subjects, and thus tend to perform better.

Table 4.14 summarizes students' responses to the questions about how much they like or dislike science. In more than one-third of the countries, a positive relationship was observed between a stronger liking of science and higher achievement. Even though the pattern was not uniform across countries, the students who reported either liking science or liking it a lot generally had higher achievement than students who reported disliking it to some degree Four-fifths or more of the fourth-graders in every country except the Netherlands indicated they liked science or liked science a lot. In the Netherlands, a third of the students reported that they disliked science.

The data in Figure 4.2 reveal that, on average, in the majority of the countries there was no significant difference between boys and girls in their degree of liking for the sciences. However, a greater percentage of boys reported liking science in Austria, Japan, and Korea, and a greater percentage of girls in Iceland and Ireland.

Three statements reflecting student attitudes to science ("I like science," "I enjoy learning science," and "science is boring") were combined to form an index of overall attitude to science. Table 4.15 characterizes student attitudes in terms of this index. Not surprisingly, the results are very similar to those in Table 4.14, with the majority of students in every country expressing positive or strongly positive attitudes. Table 4.15 does reveal a strong positive relationship between attitude to science and science achievement in many countries. Figure 4.3 confirms that in most countries, attitude to science is not related to gender, although boys had more positive attitudes in Austria, Japan, and Korea, while girls had more positive attitudes in Iceland, Ireland, and Latvia (LSS).

Table 4.14

Students' Reports on How Much They Like Science
Upper Grade (Fourth Grade*)

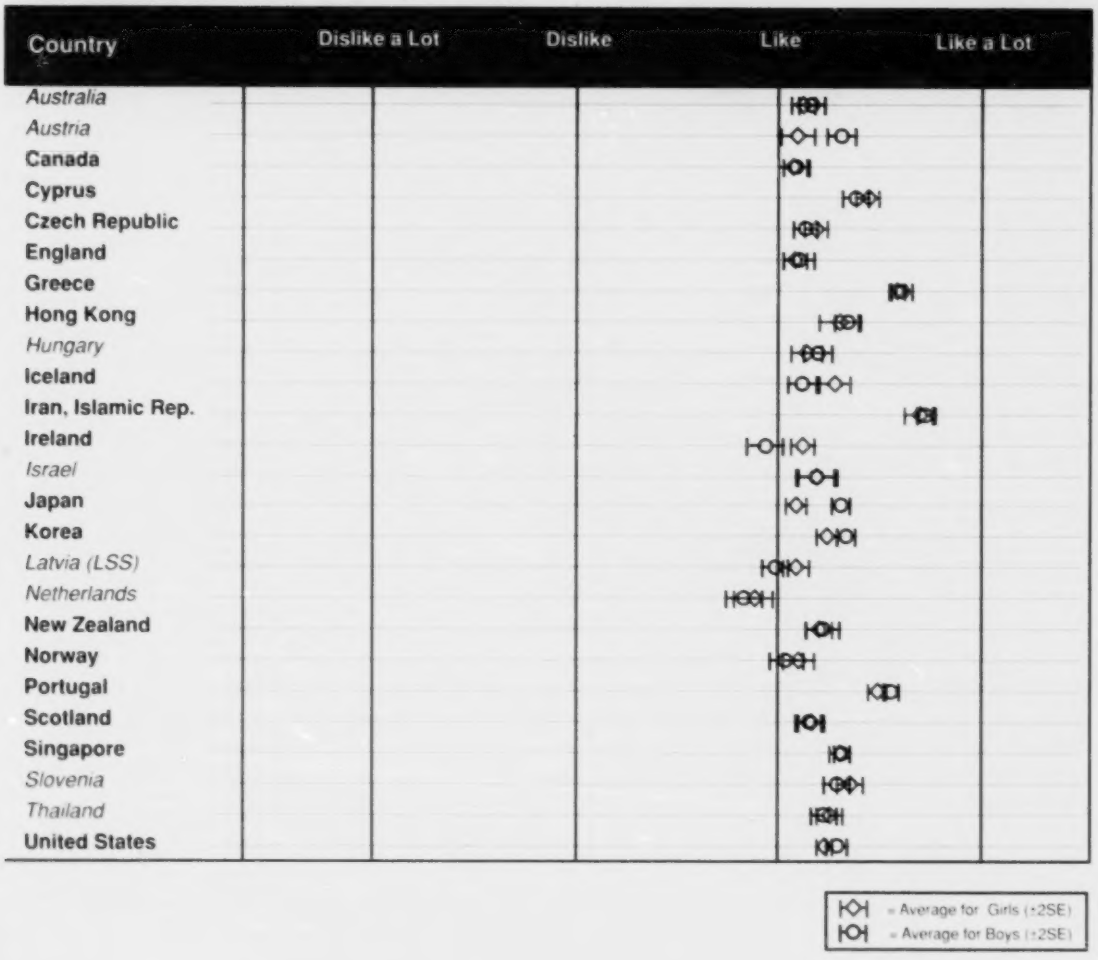
Country	Dislike a Lot		Dislike		Like		Like a Lot	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	8 (0.6)	535 (6.1)	10 (0.6)	562 (5.0)	43 (0.8)	566 (2.8)	39 (1.1)	573 (3.6)
Austria	8 (0.8)	542 (6.0)	12 (0.7)	550 (5.1)	30 (1.2)	557 (3.6)	49 (1.4)	578 (4.6)
Canada	7 (0.8)	536 (5.5)	13 (0.8)	542 (3.6)	46 (1.0)	551 (3.8)	34 (1.2)	557 (4.1)
Cyprus	4 (0.5)	467 (6.9)	6 (0.7)	458 (9.1)	36 (1.5)	483 (3.8)	54 (1.8)	479 (3.4)
Czech Republic	5 (0.5)	541 (7.5)	12 (0.8)	545 (5.7)	46 (1.0)	556 (3.2)	37 (1.4)	565 (3.7)
England	9 (0.8)	534 (6.3)	10 (0.5)	551 (7.3)	45 (1.2)	559 (3.7)	36 (1.2)	553 (4.3)
Greece	2 (0.3)	~ ~	3 (0.3)	497 (8.4)	29 (1.3)	499 (4.1)	66 (1.4)	504 (3.4)
Hong Kong	4 (0.9)	504 (15.4)	6 (0.7)	509 (7.4)	45 (1.2)	533 (3.9)	45 (1.7)	541 (4.3)
Hungary	5 (0.7)	514 (8.7)	11 (0.8)	522 (5.4)	46 (1.2)	530 (3.7)	38 (1.5)	544 (4.4)
Iceland	7 (1.1)	501 (8.9)	7 (0.8)	496 (9.4)	45 (1.6)	507 (5.0)	41 (1.5)	515 (4.2)
Iran, Islamic Rep.	r 1 (0.4)	~ ~	2 (0.4)	~ ~	22 (1.3)	424 (4.0)	75 (1.5)	423 (4.7)
Ireland	9 (0.9)	523 (6.8)	13 (0.9)	532 (4.7)	44 (1.0)	544 (3.8)	34 (1.3)	548 (4.2)
Israel	r 7 (0.8)	513 (8.2)	11 (1.0)	516 (6.8)	39 (1.6)	507 (5.3)	43 (2.2)	506 (4.6)
Japan	2 (0.2)	~ ~	12 (0.9)	553 (3.6)	49 (0.9)	571 (2.2)	36 (1.0)	587 (2.0)
Korea	2 (0.2)	~ ~	10 (0.7)	582 (3.9)	46 (1.2)	594 (2.3)	42 (1.3)	607 (2.3)
Kuwait	4 (0.5)	397 (9.1)	4 (0.4)	379 (8.1)	21 (1.1)	396 (4.7)	71 (1.6)	408 (2.8)
Latvia (LSS)	7 (0.7)	480 (7.3)	14 (1.0)	512 (7.3)	48 (1.4)	514 (6.4)	31 (1.5)	523 (6.0)
Netherlands	10 (1.0)	547 (5.8)	23 (1.3)	552 (4.2)	39 (1.2)	561 (3.9)	28 (1.6)	566 (4.5)
New Zealand	9 (0.8)	512 (11.0)	8 (0.8)	524 (8.3)	37 (1.5)	544 (5.6)	46 (1.5)	530 (6.1)
Norway	8 (0.7)	522 (6.4)	14 (1.0)	539 (6.0)	42 (1.0)	535 (3.9)	36 (1.6)	536 (4.5)
Portugal	1 (0.2)	~ ~	4 (0.4)	444 (10.1)	38 (1.1)	477 (4.7)	58 (1.2)	488 (3.8)
Scotland	8 (0.6)	513 (7.4)	10 (0.6)	530 (7.0)	40 (1.1)	544 (4.5)	42 (1.3)	541 (5.0)
Singapore	3 (0.2)	481 (10.2)	7 (0.5)	515 (9.2)	47 (1.0)	540 (4.5)	44 (1.2)	566 (5.8)
Slovenia	3 (0.4)	527 (8.6)	8 (0.7)	542 (6.5)	42 (1.4)	547 (3.5)	47 (1.7)	548 (4.5)
Thailand	2 (0.3)	~ ~	12 (1.1)	455 (6.4)	46 (1.4)	476 (4.6)	40 (1.7)	474 (6.0)
United States	6 (0.4)	529 (6.2)	9 (0.6)	548 (5.8)	38 (0.9)	570 (3.8)	47 (1.2)	573 (3.5)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A tilde (~) indicates insufficient data to report achievement.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 4.2

Gender Differences in Liking the Sciences
Upper Grade (Fourth Grade*)



*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.15

Students' Overall Attitudes[1] Towards Science
Upper Grade (Fourth Grade*)

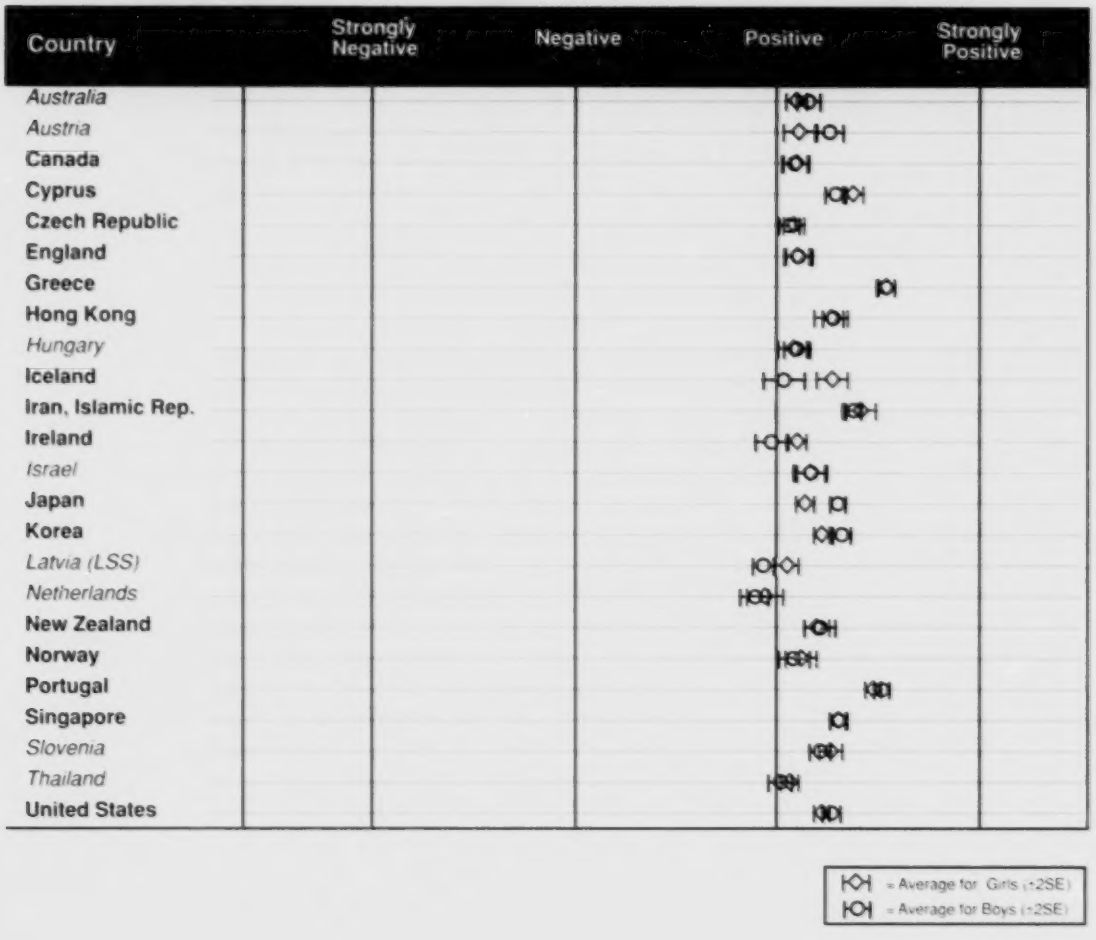
Country	Strongly Negative		Negative		Positive		Strongly Positive	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	5 (0.4)	546 (6.9)	14 (0.8)	548 (5.1)	46 (0.8)	559 (2.8)	36 (1.0)	582 (3.5)
Austria	5 (0.6)	556 (7.5)	16 (1.0)	547 (3.7)	34 (1.2)	556 (3.7)	45 (1.6)	579 (4.9)
Canada	5 (0.6)	543 (6.1)	15 (0.9)	538 (4.0)	46 (0.9)	545 (4.3)	34 (1.1)	564 (4.1)
Cyprus	1 (0.2)	~ ~	10 (0.8)	454 (6.9)	42 (1.3)	470 (3.8)	47 (1.6)	491 (3.2)
Czech Republic	2 (0.3)	~ ~	16 (0.9)	541 (4.3)	54 (0.9)	552 (3.3)	28 (1.2)	576 (4.2)
England	6 (0.6)	551 (8.5)	14 (0.9)	538 (5.7)	44 (1.1)	549 (3.9)	36 (1.2)	563 (3.7)
Greece	1 (0.2)	~ ~	4 (0.5)	490 (8.8)	34 (1.4)	485 (4.7)	61 (1.3)	512 (3.0)
Hong Kong	2 (0.4)	~ ~	9 (1.4)	506 (6.8)	50 (1.4)	525 (4.0)	39 (1.6)	551 (3.8)
Hungary	3 (0.5)	523 (10.6)	16 (1.0)	518 (4.2)	49 (1.1)	525 (3.7)	32 (1.2)	553 (4.6)
Iceland	6 (0.8)	498 (8.9)	13 (1.0)	500 (6.6)	42 (1.4)	503 (5.1)	40 (1.9)	518 (4.2)
Iran, Islamic Rep.	1 (0.2)	~ ~	5 (0.5)	404 (6.7)	49 (1.6)	405 (3.8)	46 (1.8)	440 (4.9)
Ireland	4 (0.5)	531 (9.3)	17 (1.0)	522 (4.4)	48 (1.1)	539 (3.8)	30 (1.3)	556 (4.5)
Israel r	4 (0.6)	516 (8.3)	13 (1.1)	513 (7.0)	43 (1.3)	504 (4.3)	39 (2.0)	510 (4.8)
Japan	1 (0.2)	~ ~	11 (0.8)	550 (3.8)	53 (0.9)	569 (2.1)	35 (1.1)	590 (2.0)
Korea	1 (0.2)	~ ~	11 (0.7)	573 (5.0)	48 (1.1)	590 (2.2)	40 (1.3)	613 (2.3)
Kuwait	1 (0.2)	~ ~	8 (0.8)	381 (6.2)	40 (1.0)	380 (4.4)	50 (1.4)	425 (2.6)
Latvia (LSS)	2 (0.4)	~ ~	19 (1.1)	500 (7.1)	55 (1.3)	514 (6.1)	24 (1.2)	522 (5.3)
Netherlands	8 (0.7)	561 (6.2)	21 (1.3)	553 (4.4)	44 (1.2)	556 (4.0)	28 (1.5)	568 (4.2)
New Zealand	4 (0.5)	514 (14.4)	12 (1.0)	513 (8.1)	43 (1.5)	526 (6.2)	41 (1.6)	547 (5.1)
Norway	4 (0.5)	526 (11.0)	17 (1.1)	528 (6.1)	43 (1.0)	530 (3.9)	36 (1.6)	543 (4.4)
Portugal	0 (0.1)	~ ~	4 (0.4)	431 (13.3)	41 (1.2)	462 (5.3)	54 (1.4)	500 (3.4)
Scotland	- -	- -	- -	- -	- -	- -	- -	- -
Singapore	1 (0.1)	~ ~	9 (0.5)	496 (8.6)	49 (1.0)	533 (4.5)	41 (1.2)	575 (5.8)
Slovenia	2 (0.3)	~ ~	13 (0.9)	531 (6.4)	46 (1.2)	539 (3.9)	40 (1.4)	560 (3.7)
Thailand	1 (0.2)	~ ~	15 (1.1)	446 (6.2)	64 (1.0)	472 (4.6)	20 (1.2)	493 (7.3)
United States	3 (0.3)	547 (7.6)	13 (0.7)	542 (5.6)	40 (0.9)	557 (4.1)	44 (1.2)	583 (3.3)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
[1] Index of overall attitudes towards science is based on average of responses to the following statements:
1) I like science; 2) I enjoy learning science; 3) Science is boring (reversed scale).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 4.3

Gender Differences in Students' Overall Attitudes[1] Towards Science Upper Grade (Fourth Grade*)



*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
[1]Index of overall attitudes towards mathematics is based on average of responses to the following statements:
1) I like science, 2) I enjoy learning science, 3) Science is boring (reversed scale).
Data for Scotland not available.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Chapter 5

Teachers and Instruction

Teachers and the instructional approaches they use are fundamental in building students' understanding of science. Primary among their many duties and responsibilities, teachers structure and guide the pace of individual, small-group, and whole-class work to present new material, engage students in scientific tasks, and help deepen students' grasp of the science being studied. Teachers may help students use technology and laboratory equipment to investigate scientific ideas, develop their understanding of scientific approaches to problem solving, and promote positive attitudes towards science. They also may assign homework and conduct informal as well as formal assessments to monitor progress in student learning, make instructional decisions, and evaluate achievement outcomes.

Effective science teaching is a complex endeavor requiring knowledge of the subject matter of science, understanding of student learning, and appreciation of the pedagogy of science. It can be fostered through institutional support and adequate resources. Teachers also can support each other in planning instructional strategies, devising real-world applications of scientific concepts, and developing sequences that move students from concrete tasks to the ability to think for themselves and explore scientific theories.

TIMSS administered a background questionnaire to teachers to gather information about their backgrounds and training. The questionnaire also asked about how they spend their school-related time and how science classes are organized.

This chapter presents the results of teachers' responses to some of these questions. Because the sampling for the teacher questionnaires was based on participating students, the responses to the teacher questionnaire do not necessarily represent all of the fourth-grade teachers in each of the TIMSS countries. Rather, they represent teachers of the representative samples of students assessed. It is important to note that in this report, the student is always the unit of analysis, even when information from the teachers' questionnaires is being reported. Using the student as the unit of analysis makes it possible to describe the instruction received by representative samples of students. Although this approach may provide a different perspective from that obtained by simply collecting information from teachers, it is consistent with the TIMSS goals of providing information about the educational contexts and performance of students.

In the primary grades, students generally are taught mathematics and science by a single classroom teacher who provides instruction in all subjects. Accordingly, the international version of the teacher questionnaire for the primary grades was prepared as a single document asking about demographic information and instruction in both mathematics and science. However, in some countries, a portion or even all of the

students are taught mathematics and science by different teachers, and it was difficult to make provisions for both teachers to complete the questionnaire. Also, because countries were required to sample two classes (from adjacent grades), it was possible for an individual to be the mathematics and/or science teacher of both the upper- and lower-grade classes. In order to keep the response burden for teachers to a minimum, no teacher was asked to respond to more than one questionnaire, even where that teacher taught mathematics and/or science to more than one of the sampled classes. These situations, together with the fact that teachers sometimes did not complete the questionnaire assigned to them, meant that each country had some percentage of students for whom no teacher questionnaire information was available. The tables in this chapter contain special notation regarding response rates. For a country where teacher responses were available for 70% to 84% of the students, an "r" is included next to the data for that country. When teacher responses were available for 50% to 69% of the students, an "s" is included next to the data for that country. When teacher responses were available for fewer than 50% of the students, an "x" replaces the data.

Another consequence of the desire to minimize the teacher response burden was that teacher questionnaires had to be as short as possible. Since science is not emphasized as much as mathematics in primary school in many countries, relatively fewer questions pertaining to science were included in the teacher questionnaires.

Who Delivers Science Instruction?

This section provides information about the science teaching force in each of the participating countries, in terms of certification, degrees, age, gender, and years of teaching experience.

Table 5.1 summarizes information gathered from each country about the requirements for the certification held by the majority of the third- and fourth-grade teachers. In many countries, the type of education required for qualification includes a university degree. In other countries, study at a teacher training institution is required, or even both a university degree and study at a teacher training institution. The number of years of post-secondary education required for a teaching qualification ranged from two years in Iran and Singapore to as much as six years in Canada, although many countries reported three or four years. All of the countries except Greece and Kuwait reported that teaching practice was required. A large number of countries reported that an evaluation or examination was required for certification. The countries not having such a requirement included Canada, Greece, Iran, Israel, Korea, Portugal, and the United States.

Table 5.2 contains teachers' reports on their age and gender. If a constant supply of teachers were entering the teaching force, devoting their careers to the classroom, and then retiring, one might expect approximately equal percentages of students taught by teachers in their 20s, 30s, 40s, and 50s, and this does appear to hold for some countries. In most countries, however, the majority of the fourth-grade students were

Table 5.1

Requirements for Certification Held by the Majority of Lower- and Upper-Grade (Third and Fourth Grade*) Teachers[1]

Country	Type of Education Required for Qualification	Number of Years of Post-Secondary Education Required	Teaching or Practice Experience Required	Evaluation or Examination Required
Australia	University or Teacher Training Institution	3–4	yes	yes
Austria	Teacher Training Institution	3	yes	yes
Canada	University	4–6	yes	no
Cyprus	Teacher Training Institution	3	yes	yes
Czech Republic	University	4	yes	yes
[2] England	University or Higher Education Institution	3–5	yes	yes
[3] Greece	Post-Secondary Non-University Teacher Training Institution	4	no	no
Hong Kong	Teacher Training Institution	2 or 3	yes	yes
Hungary	Teacher Training Institution	3	yes	yes
Iceland	University	3	yes	yes
Iran	Teacher Training Institution	2	yes	no
Ireland	University College	3	yes	yes
Israel	Teacher Training Institution	3	yes	no
Japan	University	4	yes	yes
Korea	University	4	yes	no
Kuwait	University	4	no	yes
Latvia	Teacher Training Institution	3	yes	yes
Netherlands	Teacher Training Institution	3[4]	yes	yes
New Zealand	Teacher Training Institution	3	yes	yes
Norway	Teacher Training Institution	3[5]	yes	yes
Portugal	Teacher Training Institution	3[6]	yes	no
Scotland	University or Teacher Training Institution	4	yes	yes
Singapore	Teacher Training Institution	2	yes	yes
Slovenia	University	4	yes	yes
Thailand	University or Teacher Training Institution	4	yes	yes
[7] United States	University	4	yes	no

*Third and fourth grades in most countries; see Table 2 for more information about the grades tested in each country.

[1] Certification pertains to the majority (more than 50%) of teachers of lower- and upper-grade students in each country.

[2] England: The majority of teachers of primary schools students will have studied education and their specialist subject concurrently for 4 years (with honors) or 3 years (B. Ed without honors). Some, however, will have studied their specialist subject for a degree (B. Sc. or B.A.) for 3 or 4 years followed by a one-year post graduate course. All teachers who qualified since 1975 are graduates. Some teachers who qualified before this date hold teachers' certificates but are not graduates.

[3] Greece: The vast majority of primary school teachers are Post-Secondary Non-University Teacher Training Institute graduates (last graduates 1990). Only a small fraction of existing teachers are graduates of the newly founded University Education Departments (first graduates 1989).

[4] Netherlands: As of August 1984 a 4-year teacher training program integrating training for kindergarten and primary education is required. Before August 1994, 3 years of teacher training were required for primary education.

[5] Norway: Until 1965 2 years of post-secondary education were required. Between 1965 and 1995 3 years were required. As of 1996, new certified teachers are required to have completed 4 years of post-secondary education.

[6] Portugal: Until 1986 2 years of post-secondary education were required. As of 1986 3 years are required.

[7] United States: Certification requirements vary considerably according to state in the United States. Information in this table represents the most typical requirements across states.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

Table 5.2

Teachers' Reports on Their Age and Gender
Science - Upper Grade (Fourth Grade*)

Country	Percent of Students Taught by Teachers				Percent of Students Taught by Teachers	
	29 Years or Under	30 - 39 Years	40 - 49 Years	50 Years or Older	Female	Male
Australia	21 (3.0)	31 (3.4)	35 (3.4)	12 (2.2)	65 (4.0)	35 (4.0)
Austria	10 (2.6)	29 (4.6)	47 (5.0)	15 (3.4)	78 (4.3)	22 (4.3)
Canada	6 (1.6)	25 (3.8)	43 (3.1)	26 (2.6)	74 (3.5)	26 (3.5)
Cyprus s	47 (5.9)	20 (4.4)	22 (5.3)	11 (3.3)	s 69 (4.5)	31 (4.5)
Czech Republic r	13 (3.2)	21 (3.4)	21 (3.6)	45 (4.1)	r 95 (1.8)	5 (1.8)
England	16 (3.8)	17 (4.0)	50 (5.1)	17 (3.3)	75 (3.5)	25 (3.5)
Greece	12 (2.8)	41 (4.3)	33 (4.1)	14 (2.9)	49 (4.6)	51 (4.6)
Hong Kong	- -	- -	- -	- -	- -	- -
Hungary	8 (2.3)	43 (4.7)	29 (3.8)	21 (3.7)	90 (2.7)	10 (2.7)
Iceland	10 (1.7)	34 (5.5)	47 (5.1)	8 (2.1)	83 (3.8)	17 (3.8)
Iran, Islamic Rep.	42 (4.2)	43 (4.5)	14 (2.8)	1 (0.8)	54 (4.3)	46 (4.3)
Ireland	17 (3.3)	31 (4.1)	31 (4.5)	22 (4.1)	69 (3.9)	31 (3.9)
Israel	24 (4.6)	46 (5.9)	21 (4.4)	9 (2.7)	95 (1.6)	5 (1.6)
Japan	12 (2.7)	40 (4.1)	38 (4.5)	11 (2.3)	61 (3.9)	39 (3.9)
Korea	22 (3.2)	29 (3.0)	33 (3.9)	16 (2.8)	64 (3.8)	36 (3.8)
Kuwait s	22 (4.1)	50 (4.8)	20 (3.7)	8 (2.9)	s 57 (2.9)	43 (2.9)
Latvia (LSS)	23 (4.0)	37 (4.1)	15 (3.2)	26 (4.1)	98 (1.2)	2 (1.2)
Netherlands	17 (3.3)	29 (4.1)	40 (4.6)	14 (3.4)	35 (4.3)	65 (4.3)
New Zealand	21 (3.4)	27 (3.3)	37 (4.3)	15 (2.5)	69 (3.5)	31 (3.5)
Norway	8 (2.6)	14 (3.6)	42 (4.7)	36 (4.8)	78 (3.9)	22 (3.9)
Portugal	6 (2.3)	21 (3.5)	48 (4.2)	25 (3.8)	95 (1.9)	5 (1.9)
Scotland	19 (3.1)	21 (3.6)	40 (4.6)	19 (3.4)	92 (2.1)	8 (2.1)
Singapore	38 (4.1)	15 (2.7)	28 (3.5)	19 (2.7)	78 (2.9)	22 (2.9)
Slovenia	12 (3.1)	34 (4.9)	30 (4.5)	24 (4.6)	92 (2.6)	8 (2.6)
Thailand	4 (2.3)	54 (5.2)	29 (4.7)	13 (4.1)	57 (6.1)	43 (6.1)
United States	17 (2.8)	22 (2.9)	37 (4.3)	24 (4.0)	86 (2.5)	14 (2.5)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (-) indicates data are not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

taught science by teachers in their 30s or 40s. Very few countries seemed to have a comparatively younger teaching force, with only Cyprus, Iran, and Singapore having 25% or more of the students with science teachers in their 20s or younger. Twelve countries (Australia, Cyprus, Greece, Hungary, Iran, Israel, Japan, Korea, Kuwait, Latvia (LSS), Singapore, and Thailand) had the majority of students with teachers in their 30s or younger. Countries with comparatively larger percentages of older teachers included Canada, the Czech Republic, Latvia (LSS), Norway, and Portugal, where 25% or more of the fourth-grade students had science teachers in their 50s or older.

In every country except Greece and the Netherlands, the majority of fourth-grade students were taught science by female teachers. Countries with particularly large percentages of female teachers included the Czech Republic, Hungary, Israel, Latvia (LSS), Portugal, Scotland, and Slovenia, where 90% or more of the fourth-grade students were taught science by female teachers.

As might be expected from the differences in teachers' ages from country to country, the TIMSS data indicate differences in teacher experience across countries (see Table 5.3). The countries with younger teaching forces tended to have more students taught by less experienced teachers. At least half the fourth-grade students in Cyprus, Iran, and Kuwait had science teachers with 10 years or less of experience. In all of the other countries, the majority of students were taught science by teachers with more than 10 years of teaching experience. In the Czech Republic and Portugal more than half the students had science teachers with over 20 years of experience.

The relationship between years of teaching experience and science achievement is not clear in many countries. In about one-fourth of the countries, the fourth-grade students with the most experienced teachers (more than 20 years) had higher science achievement than did those with less experienced teachers (five years or fewer). This may reflect the practice of giving teachers with more seniority the more advanced classes. However, there were also several countries where the students with less experienced teachers had higher achievement than did those with the most experienced teachers.

Table 5.3

Teachers' Reports on Their Years of Teaching Experience
Science - Upper Grade (Fourth Grade*)

Country		0 - 5 Years		6-10 Years		11-20 Years		More than 20 Years	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	r	14 (2.3)	572 (5.6)	23 (3.1)	556 (6.0)	38 (3.5)	566 (5.6)	25 (3.4)	560 (5.6)
Austria		10 (2.7)	566 (8.5)	11 (3.3)	571 (6.0)	31 (4.1)	552 (6.8)	47 (4.9)	571 (5.6)
Canada		10 (1.7)	537 (7.0)	17 (2.9)	553 (8.4)	27 (3.3)	545 (6.4)	46 (3.5)	554 (4.5)
Cyprus	s	53 (6.2)	485 (5.8)	12 (3.5)	470 (12.7)	9 (3.0)	471 (10.3)	27 (5.2)	482 (9.6)
Czech Republic	r	16 (3.1)	541 (7.7)	9 (2.6)	541 (8.1)	18 (3.0)	561 (6.7)	56 (4.4)	561 (5.5)
England		18 (3.5)	555 (8.0)	16 (3.6)	556 (12.6)	34 (4.0)	548 (5.5)	33 (4.2)	553 (7.3)
Greece		11 (2.5)	503 (21.8)	22 (3.3)	493 (5.0)	31 (4.1)	498 (6.3)	36 (4.0)	505 (6.3)
Hong Kong		- -	- -	- -	- -	- -	- -	- -	- -
Hungary		7 (2.6)	529 (12.7)	11 (2.9)	526 (9.6)	42 (4.6)	534 (4.3)	40 (4.7)	533 (6.6)
Iceland		23 (4.0)	513 (3.4)	21 (4.6)	504 (9.9)	34 (5.5)	508 (5.8)	22 (4.5)	501 (7.0)
Iran, Islamic Rep.		33 (4.1)	400 (10.7)	19 (3.9)	416 (7.0)	40 (4.6)	425 (7.0)	8 (2.6)	443 (9.1)
Ireland		10 (2.9)	527 (17.9)	14 (3.4)	532 (7.7)	32 (4.1)	542 (5.6)	44 (4.6)	543 (5.8)
Israel	r	35 (5.3)	503 (7.5)	13 (3.6)	515 (9.4)	32 (4.9)	506 (6.1)	20 (4.0)	486 (8.2)
Japan		11 (2.8)	570 (6.1)	10 (2.5)	570 (4.9)	57 (3.6)	575 (2.2)	22 (3.0)	574 (4.2)
Korea		12 (2.6)	594 (7.7)	23 (3.4)	601 (3.3)	27 (3.5)	598 (4.0)	38 (3.8)	594 (3.1)
Kuwait	s	21 (3.9)	401 (6.9)	29 (4.0)	404 (9.4)	44 (5.0)	397 (6.5)	6 (1.8)	439 (12.9)
Latvia (LSS)		15 (3.5)	487 (9.5)	16 (3.2)	501 (12.6)	33 (4.5)	510 (8.7)	36 (4.8)	527 (8.6)
Netherlands		14 (2.5)	548 (8.6)	11 (2.9)	550 (7.9)	39 (3.9)	563 (3.7)	36 (4.8)	556 (6.2)
New Zealand		23 (3.8)	525 (11.2)	15 (2.9)	539 (14.6)	39 (4.6)	523 (8.0)	22 (3.3)	550 (7.7)
Norway		10 (3.0)	529 (9.8)	8 (2.7)	517 (9.6)	32 (4.8)	531 (5.4)	50 (5.4)	527 (5.0)
Portugal		6 (2.0)	444 (20.7)	9 (2.0)	468 (9.0)	15 (3.0)	479 (8.2)	70 (3.9)	484 (4.9)
Scotland		25 (3.8)	526 (8.5)	19 (3.3)	550 (8.1)	33 (4.3)	531 (9.8)	23 (3.9)	546 (8.2)
Singapore		34 (4.1)	555 (9.5)	9 (2.2)	561 (16.2)	11 (2.4)	557 (17.7)	46 (3.7)	535 (6.1)
Slovenia		10 (2.7)	538 (10.8)	14 (3.5)	542 (8.1)	32 (4.9)	543 (6.9)	44 (4.9)	547 (4.8)
Thailand	r	28 (4.5)	457 (11.1)	16 (4.1)	477 (14.8)	45 (6.9)	478 (8.9)	12 (5.1)	507 (38.8)
United States		21 (2.8)	558 (6.7)	18 (2.8)	578 (4.8)	29 (2.6)	574 (5.5)	32 (3.0)	569 (6.1)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (-) indicates data are not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

How Do Science Teachers Spend Their School-Related Time?

Countries vary considerably in the degree of emphasis placed on science instruction in the primary school years. While in some countries science occupies a prominent position in the fourth-grade curriculum, in others science instruction is just beginning, and is sometimes integrated with other subjects such as social or environmental studies. In TIMSS, teachers were asked about the average amount of time science is taught to their class each week. The results, displayed in Table 5.4, confirm the picture of international differences in instructional time for science at the fourth grade.

In half the countries, a large majority of students were taught by teachers who reported that science is taught for less than two hours in their classrooms. Countries where teachers reported the least amount of science teaching included Australia, Ireland, Latvia (LSS), the Netherlands, New Zealand, Norway, and Scotland. In Austria, Japan, Korea, Kuwait, and Singapore the norm for science teaching was between two and three hours, with more than 95% of students taught by teachers who reported teaching science for this amount of time. In five countries, Canada, England, Portugal, Thailand, and the United States, more than 20% of students had three hours of more of science weekly. The relationship within countries between time spent teaching science and student achievement was inconsistent.

Since science teaching is sometimes integrated with other instructional activities in primary school, teachers were asked whether or not science is taught mainly as a separate subject in their class in many of the countries. A large majority of students were taught science as a separate subject, including Israel, Japan, Korea, Kuwait, and Singapore, where this was true for 100% of fourth-grade students (Table 5.5). Among countries where large percentages of students were not taught science as a separate subject were Iceland, Ireland, New Zealand, Norway, Portugal, Scotland, and Thailand. In countries where teacher reports indicated that either approach may be found, generally there were no large differences in the time spent teaching science between those to whom science is taught as a separate subject and the others.

In many countries around the world, primary school classes are taught by a single teacher who is responsible for teaching all subjects in the curriculum. However, there are also many variations on this model, and in some countries it is customary for the classroom teacher to call on specialized teachers to teach particular subjects, such as science, music, or art. Figure 5.1 classifies the TIMSS countries according to the percentage of students who were taught both mathematics and science by a single classroom teacher. In most of the countries, almost all students were taught by teachers who teach both mathematics and science. The major exceptions were Hong Kong, Israel, and Kuwait, where most students had different teachers for mathematics and science.

In addition to the time spent in class on science instruction, teachers were asked about the number of hours per week spent on selected school-related activities outside the regular school day. Table 5.6 presents the results. For example, on average, fourth-grade students in Australia had science teachers who spent 1.1 hours per week preparing

Table 5.4

Teachers' Reports on Average Number of Hours Science is Taught Weekly to Their Science Class - Upper Grade (Fourth Grade*)

Country		Less Than 1 Hour		1 Hour to < 2		2 Hours to < 3		3 Hours or More	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	r	35 (3.9)	556 (5.0)	55 (4.0)	568 (5.9)	5 (1.5)	562 (18.1)	5 (2.1)	562 (8.4)
Austria		0 (0.0)	~ ~	0 (0.0)	~ ~	97 (1.8)	566 (3.6)	3 (1.8)	540 (30.3)
Canada		8 (2.0)	536 (10.1)	42 (3.8)	542 (5.1)	27 (3.3)	567 (5.4)	23 (3.2)	550 (4.6)
Cyprus		x x	x x	x x	x x	x x	x x	x x	x x
Czech Republic		2 (1.1)	~ ~	79 (3.6)	557 (3.9)	3 (1.4)	572 (6.8)	16 (3.2)	563 (7.3)
England		6 (1.7)	540 (8.7)	27 (4.1)	548 (7.5)	44 (4.8)	556 (5.9)	23 (3.8)	550 (8.2)
Greece		- -	- -	- -	- -	- -	- -	- -	- -
Hong Kong		13 (3.4)	530 (13.3)	84 (3.7)	534 (4.3)	2 (1.5)	~ ~	1 (0.8)	~ ~
Hungary		6 (2.2)	556 (13.3)	72 (4.1)	529 (3.7)	8 (3.0)	521 (8.4)	14 (3.1)	549 (10.5)
Iceland	r	17 (4.1)	513 (7.3)	41 (5.6)	504 (7.7)	30 (5.1)	499 (6.5)	12 (4.3)	523 (6.8)
Iran, Islamic Rep.		- -	- -	- -	- -	- -	- -	- -	- -
Ireland		47 (5.0)	536 (5.6)	40 (4.4)	540 (5.8)	11 (3.1)	550 (7.1)	2 (0.9)	~ ~
Israel	r	0 (0.0)	~ ~	53 (5.6)	508 (5.5)	32 (5.8)	494 (6.9)	15 (4.3)	493 (10.6)
Japan		2 (1.3)	~ ~	1 (0.6)	~ ~	95 (1.8)	575 (1.8)	2 (1.2)	~ ~
Korea		0 (0.0)	~ ~	1 (0.6)	~ ~	95 (1.8)	597 (1.9)	5 (1.7)	588 (10.3)
Kuwait	s	0 (0.0)	~ ~	1 (0.7)	~ ~	96 (2.0)	402 (3.9)	4 (1.8)	416 (42.2)
Latvia (LSS)		89 (2.9)	505 (5.7)	5 (2.2)	538 (47.2)	5 (2.2)	532 (11.9)	1 (0.8)	~ ~
Netherlands		38 (5.1)	559 (4.0)	44 (4.8)	556 (4.5)	9 (2.6)	556 (7.2)	9 (2.7)	549 (20.1)
New Zealand	r	29 (4.2)	542 (8.3)	48 (4.4)	536 (6.1)	14 (3.1)	537 (17.2)	9 (2.6)	509 (21.2)
Norway	s	73 (5.0)	527 (5.4)	27 (5.0)	535 (7.6)	0 (0.0)	~ ~	0 (0.0)	~ ~
Portugal		2 (1.1)	~ ~	3 (1.4)	486 (28.2)	12 (3.1)	474 (8.8)	84 (3.6)	481 (4.8)
Scotland	r	35 (4.7)	543 (5.9)	44 (4.7)	534 (6.4)	14 (3.3)	531 (13.2)	7 (2.5)	529 (12.5)
Singapore		0 (0.0)	~ ~	4 (1.5)	548 (18.9)	96 (1.5)	547 (5.1)	0 (0.0)	~ ~
Slovenia		3 (1.9)	544 (18.9)	60 (5.3)	541 (4.6)	18 (4.0)	550 (9.5)	19 (3.4)	548 (6.8)
Thailand	r	2 (1.2)	~ ~	9 (3.5)	463 (21.5)	17 (6.1)	469 (16.5)	73 (6.6)	477 (6.5)
United States	r	9 (2.1)	562 (11.5)	16 (2.9)	550 (10.2)	33 (3.8)	578 (5.9)	42 (4.1)	565 (5.1)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.
An "x" indicates teacher response data available for <50% students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.5

Teachers' Reports on Whether Science is Taught Mainly as a Separate Subject – Upper Grade (Fourth Grade*)

Country		Yes		No	
		Percent of Students	Average Hours of Science Taught Weekly	Percent of Students	Average Hours of Science Taught Weekly
Australia	r	51 (4.4)	1.0 (0.04)	49 (4.4)	1.4 (0.17)
Austria		- -	- -	- -	- -
Canada		68 (3.6)	2.2 (0.11)	32 (3.6)	2.3 (0.31)
Cyprus		x x	x x	x x	x x
Czech Republic		95 (1.6)	1.8 (0.05)	5 (1.6)	1.8 (0.30)
England		74 (4.9)	2.2 (0.08)	26 (4.9)	2.2 (0.24)
Greece		- -	- -	- -	- -
Hong Kong		91 (2.7)	1.1 (0.03)	9 (2.7)	1.5 (0.28)
Hungary		87 (2.7)	1.8 (0.09)	13 (2.7)	2.9 (0.59)
Iceland	r	21 (4.5)	1.3 (0.17)	79 (4.5)	1.9 (0.15)
Iran, Islamic Rep.		- -	- -	- -	- -
Ireland		16 (3.1)	0.9 (0.14)	84 (3.1)	1.0 (0.07)
Israel	r	100 (0.0)	2.4 (0.22)	0 (0.0)	~ ~
Japan		100 (0.0)	2.2 (0.02)	0 (0.0)	~ ~
Korea		100 (0.0)	2.7 (0.03)	0 (0.0)	~ ~
Kuwait	s	100 (0.0)	2.2 (0.03)	0 (0.0)	~ ~
Latvia (LSS)		99 (1.0)	0.8 (0.03)	1 (1.0)	~ ~
Netherlands		81 (3.7)	1.2 (0.08)	19 (3.7)	1.5 (0.21)
New Zealand		46 (4.9)	1.4 (0.13)	54 (4.9)	1.4 (0.13)
Norway		0 (0.0)	~ ~	100 (0.0)	0.8 (0.04)
Portugal		22 (4.0)	4.0 (0.25)	78 (4.0)	4.4 (0.18)
Scotland		18 (3.1)	1.1 (0.10)	82 (3.1)	1.3 (0.12)
Singapore		100 (0.0)	2.0 (0.01)	0 (0.0)	~ ~
Slovenia		72 (5.0)	2.0 (0.10)	28 (5.0)	2.3 (0.28)
Thailand	r	1 (1.0)	~ ~	99 (1.0)	4.1 (0.26)
United States	r	83 (2.7)	2.7 (0.13)	17 (2.7)	2.6 (0.23)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.
An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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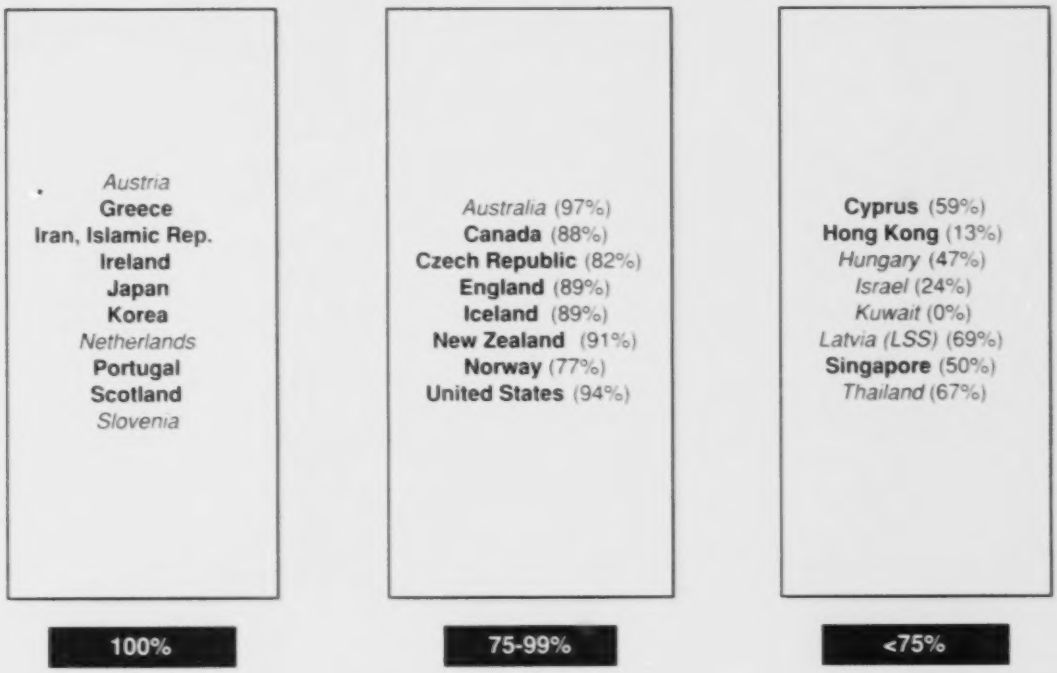
Figure 5.1

Percent of Students Who Are Taught Both Mathematics and Science by a Single Classroom Teacher[1] - Upper Grade (Fourth Grade*)



*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Based on information provided by schools. Teachers were classified as teaching: (1) mathematics, (2) science, or (3) both mathematics and science to the sampled classes. Percentages reflect those students taught by category (3) teachers.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.6

Average Number of Hours[1] Students' Teachers Spend on Various School-Related Activities Outside the Formal School Day During the School Week Science - Upper Grade (Fourth Grade*)

Country	Preparing or Grading Tests	Reading and Grading Student Work	Planning Lessons by Self	Meeting with Students Outside Classroom Time	Meeting with Parents	Professional Reading and Development	Keeping Students Records	Administrative Tasks
Australia	r 1.1 (0.1)	2.8 (0.1)	r 2.9 (0.1)	r 0.7 (0.1)	r 0.8 (0.1)	1.4 (0.1)	1.3 (0.1)	3.0 (0.1)
Austria	2.6 (0.2)	4.0 (0.1)	3.3 (0.1)	0.3 (0.0)	0.8 (0.1)	1.5 (0.1)	1.1 (0.1)	1.5 (0.1)
Canada	1.7 (0.1)	2.8 (0.1)	2.9 (0.1)	1.0 (0.1)	0.6 (0.0)	1.1 (0.1)	1.3 (0.1)	2.3 (0.1)
Cyprus	s 2.2 (0.1)	s 2.5 (0.2)	s 3.3 (0.2)	s 0.3 (0.2)	s 0.7 (0.1)	s 1.4 (0.2)	s 0.9 (0.1)	s 1.3 (0.1)
Czech Republic	r 2.7 (0.1)	r 3.1 (0.1)	r 3.5 (0.2)	r 1.2 (0.1)	r 0.5 (0.0)	r 1.8 (0.1)	r 1.1 (0.1)	r 1.0 (0.1)
England	r 0.9 (0.1)	4.0 (0.1)	3.5 (0.1)	1.0 (0.1)	0.8 (0.1)	1.3 (0.1)	1.5 (0.1)	3.3 (0.1)
Greece	2.5 (0.1)	2.1 (0.1)	r 1.9 (0.1)	r 0.3 (0.0)	0.9 (0.0)	1.9 (0.1)	r 0.5 (0.1)	r 1.1 (0.1)
Hong Kong	- -	- -	- -	- -	- -	- -	- -	- -
Hungary	2.6 (0.1)	2.8 (0.1)	3.6 (0.1)	1.6 (0.1)	0.9 (0.0)	2.0 (0.1)	0.7 (0.1)	2.2 (0.1)
Iceland	1.0 (0.1)	3.0 (0.2)	3.7 (0.1)	0.6 (0.1)	0.7 (0.1)	1.3 (0.1)	1.3 (0.1)	2.3 (0.2)
Iran, Islamic Rep.	2.2 (0.1)	2.2 (0.1)	2.0 (0.1)	1.2 (0.1)	1.3 (0.1)	1.0 (0.1)	1.7 (0.1)	1.1 (0.1)
Ireland	1.2 (0.1)	2.1 (0.2)	1.6 (0.1)	0.3 (0.0)	0.4 (0.0)	0.6 (0.1)	0.8 (0.1)	1.0 (0.1)
Israel	3.1 (0.2)	2.9 (0.2)	3.7 (0.2)	r 1.3 (0.1)	1.1 (0.1)	r 3.3 (0.1)	r 1.7 (0.2)	1.9 (0.2)
Japan	2.4 (0.1)	3.0 (0.1)	2.7 (0.1)	1.3 (0.1)	0.4 (0.0)	2.1 (0.1)	1.7 (0.1)	2.4 (0.1)
Korea	1.5 (0.1)	2.2 (0.1)	2.1 (0.1)	1.4 (0.1)	0.5 (0.0)	1.5 (0.1)	1.3 (0.1)	2.0 (0.1)
Kuwait	s 2.3 (0.1)	s 2.4 (0.1)	s 2.1 (0.2)	s 0.3 (0.1)	s 0.9 (0.1)	s 1.1 (0.1)	s 1.6 (0.2)	s 1.4 (0.1)
Latvia (LSS)	1.9 (0.1)	2.6 (0.1)	2.7 (0.1)	2.1 (0.2)	1.0 (0.1)	1.4 (0.1)	r 1.0 (0.1)	1.2 (0.1)
Netherlands	1.5 (0.1)	3.8 (0.1)	2.6 (0.1)	0.9 (0.1)	0.8 (0.0)	1.1 (0.1)	0.9 (0.1)	2.8 (0.1)
New Zealand	1.3 (0.1)	2.6 (0.1)	3.1 (0.1)	0.7 (0.1)	0.7 (0.0)	1.5 (0.1)	1.7 (0.1)	3.3 (0.1)
Norway	r 1.3 (0.1)	r 2.4 (0.1)	r 3.9 (0.1)	r 0.6 (0.1)	r 0.7 (0.1)	r 0.7 (0.1)	r 0.8 (0.0)	r 1.7 (0.1)
Portugal	2.4 (0.1)	2.7 (0.1)	2.4 (0.1)	0.6 (0.1)	0.7 (0.0)	1.4 (0.1)	0.9 (0.1)	1.5 (0.1)
Scotland	r 0.8 (0.1)	r 3.2 (0.1)	3.3 (0.1)	0.2 (0.0)	r 0.4 (0.0)	1.1 (0.1)	1.1 (0.1)	2.5 (0.1)
Singapore	3.0 (0.1)	4.1 (0.1)	2.5 (0.1)	2.0 (0.1)	0.6 (0.0)	1.6 (0.1)	1.2 (0.1)	2.4 (0.1)
Slovenia	2.3 (0.1)	2.1 (0.1)	3.7 (0.2)	1.1 (0.1)	1.3 (0.1)	2.2 (0.2)	0.8 (0.1)	1.9 (0.1)
Thailand	r 2.4 (0.2)	2.5 (0.2)	r 2.9 (0.2)	r 1.8 (0.2)	r 1.7 (0.2)	r 1.9 (0.2)	r 1.6 (0.2)	1.9 (0.2)
United States	2.2 (0.1)	3.1 (0.1)	2.5 (0.1)	0.9 (0.1)	0.7 (0.0)	1.3 (0.1)	1.5 (0.1)	2.2 (0.1)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.

Average hours based on: No time = 0, Less than 1 hour = .5, 1-2 hours = 1.5, 3-4 hours = 3.5, More than 4 hours = 5.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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or grading tests, and another 2.8 hours per week reading and grading student work. Their teachers spent 2.9 hours per week on lesson planning and 1.5 hours combined on meeting students and parents. They spent 1.4 hours on professional reading and development, and 4.3 hours on record-keeping and administrative tasks combined. Across countries, teachers reported that grading tests, grading student work, and lesson planning were the most time-consuming activities, averaging as much as almost 10 hours per week in Singapore. In general, teachers also reported several hours per week spent on keeping students' records and other administrative tasks.

Opportunities to meet with colleagues to plan curriculum or teaching approaches enable teachers to expand their views of science, their resources for teaching, and their repertoire of teaching and learning skills. Table 5.7 contains teachers' reports on how often they meet with other teachers in their subject area to discuss and plan curriculum or teaching approaches. Teachers of the majority of the students reported weekly or even daily planning meetings in 17 countries, with the largest percentages in the Czech Republic, England, Hungary, Japan, Kuwait, and Norway. In the remaining countries, however, most students were taught science by teachers who reported only limited opportunities to plan curriculum or teaching approaches with other teachers (monthly or even yearly meetings).

Most educational systems provide curriculum guides on either a national or regional basis to ensure that teachers, parents, and other interested parties have a clear understanding of what is intended to be taught in each subject. Table 5.8 displays the percentage of students taught by teachers who reported varying degrees of familiarity with national and regional guides in science. Generally teachers reported a fairly high degree of familiarity with one or another curriculum guide. Countries where more than a third of the students were taught by teachers who reported that they were unfamiliar with their country's curriculum guides included Austria, the Czech Republic, Japan, and the United States.

Table 5.7

Teachers' Reports on How Often They Meet with Other Teachers in Their Subject Area to Discuss and Plan Curriculum or Teaching Approaches Science - Upper Grade (Fourth Grade*)

Country		Percent of Students Taught by Teachers			
		Never or Once/Twice a Year	Monthly or Every Other Month	Once, Twice, or Three Times a Week	Almost Every Day
Australia		7 (1.8)	32 (3.5)	51 (3.8)	10 (2.7)
Austria		19 (4.4)	23 (4.6)	36 (4.6)	22 (4.1)
Canada		33 (3.4)	34 (3.5)	27 (2.5)	6 (1.8)
Cyprus	s	13 (3.4)	13 (4.5)	64 (5.6)	11 (4.0)
Czech Republic	r	3 (1.5)	13 (2.7)	31 (4.4)	52 (4.7)
England		4 (1.6)	12 (3.0)	72 (4.1)	13 (3.0)
Greece		32 (3.9)	26 (3.3)	26 (3.7)	16 (3.3)
Hong Kong		- -	- -	- -	- -
Hungary		2 (1.0)	13 (3.1)	45 (4.5)	41 (4.5)
Iceland		16 (1.5)	13 (4.1)	69 (4.1)	1 (1.2)
Iran, Islamic Rep.		4 (1.5)	26 (4.3)	54 (4.9)	16 (3.2)
Ireland		46 (5.0)	42 (4.7)	7 (2.0)	5 (1.5)
Israel		10 (3.6)	42 (5.9)	41 (6.4)	7 (3.3)
Japan		5 (1.7)	14 (3.0)	61 (4.2)	20 (3.9)
Korea		17 (3.0)	24 (3.5)	41 (4.2)	18 (3.2)
Kuwait	s	7 (2.5)	1 (0.9)	75 (4.0)	17 (3.8)
Latvia (LSS)		14 (3.3)	28 (4.1)	32 (4.6)	26 (3.8)
Netherlands		36 (4.4)	33 (4.4)	29 (3.8)	2 (1.5)
New Zealand		10 (2.4)	17 (3.3)	60 (4.4)	13 (2.6)
Norway		4 (1.5)	7 (2.5)	82 (3.5)	7 (2.7)
Portugal		10 (2.6)	62 (4.4)	17 (3.4)	11 (2.8)
Scotland		9 (2.3)	37 (4.3)	40 (4.0)	14 (2.9)
Singapore		11 (2.0)	64 (3.7)	21 (3.2)	4 (1.6)
Slovenia		4 (2.3)	33 (4.9)	31 (4.4)	32 (4.7)
Thailand	r	62 (5.7)	23 (5.3)	13 (4.5)	1 (0.9)
United States		19 (3.4)	21 (3.4)	49 (3.6)	11 (2.1)

*Fourth grade in most countries, see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (-) indicates data are not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.8

Teachers' Reports on Their Familiarity With National and Regional Science Curriculum Guides
Science - Upper Grade (Fourth Grade*)

Country		Percent of Students by Teachers' Familiarity With National Curriculum Guide				Regional Curriculum Guide		
		Not Familiar	Fairly Familiar	Very Familiar		Not Familiar	Fairly Familiar	Very Familiar
Australia	r	43 (4.0)	42 (4.1)	15 (2.6)	r	15 (3.3)	54 (4.7)	31 (4.3)
Austria		- -	- -	- -		40 (4.9)	28 (4.3)	32 (4.9)
Canada		- -	- -	- -		11 (2.5)	38 (3.3)	51 (2.6)
Cyprus	s	6 (1.9)	39 (6.0)	55 (6.1)		- -	- -	- -
Czech Republic	r	44 (4.9)	43 (4.5)	13 (3.1)	r	92 (2.6)	7 (2.5)	1 (0.8)
England		- -	- -	- -		- -	- -	- -
Greece	r	26 (3.3)	54 (4.2)	20 (3.4)		- -	- -	- -
Hong Kong		- -	- -	- -		- -	- -	- -
Hungary		- -	- -	- -		- -	- -	- -
Iceland		17 (5.0)	69 (5.8)	14 (3.6)		- -	- -	- -
Iran, Islamic Rep.		31 (4.6)	46 (5.3)	23 (4.1)		- -	- -	- -
Ireland		4 (2.0)	58 (4.7)	38 (4.5)		- -	- -	- -
Israel	r	11 (3.8)	40 (6.0)	50 (5.5)	r	37 (5.1)	29 (5.3)	34 (4.7)
Japan		34 (4.0)	61 (4.3)	5 (2.1)		58 (4.1)	41 (4.2)	1 (1.0)
Korea		18 (3.2)	58 (4.0)	24 (3.9)		56 (3.8)	37 (3.9)	7 (2.2)
Kuwait	s	0 (0.0)	18 (4.2)	82 (4.2)		- -	- -	- -
Latvia (LSS)		6 (2.2)	35 (4.5)	60 (4.8)	r	46 (5.1)	25 (4.5)	29 (5.1)
Netherlands		19 (3.6)	69 (4.2)	12 (3.2)		- -	- -	- -
New Zealand		9 (1.9)	59 (4.1)	32 (4.0)		76 (3.6)	20 (3.5)	5 (1.5)
Norway		2 (1.2)	69 (4.6)	29 (4.5)	r	61 (4.5)	29 (5.0)	10 (3.3)
Portugal		32 (4.4)	17 (3.2)	52 (4.4)		- -	- -	- -
Scotland		- -	- -	- -		- -	- -	- -
Singapore		2 (0.9)	54 (3.5)	44 (3.6)		- -	- -	- -
Slovenia		47 (4.7)	36 (4.6)	17 (3.7)		3 (2.1)	11 (3.7)	86 (4.2)
Thailand	r	22 (4.8)	28 (5.5)	50 (5.7)	r	56 (7.6)	34 (7.5)	10 (3.7)
United States		- -	- -	- -	r	36 (2.8)	39 (2.7)	25 (3.3)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A dash (-) indicates data are not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

How Are Science Classes Organized?

Instructional organization can subsume many factors, including the diversity of the students placed into classrooms, economic factors such as the array of instructional resources available to the student population as well as for use within classrooms, the typical size of classes, and practices regarding in-class grouping. Often, how instruction is organized can influence the implemented curriculum and the opportunities of students.

Figure 5.2 provides information on teacher reports about several factors that might limit how they teach their science classes. The results are presented visually via pie graphs. The percentage of teachers reporting that a particular factor limited how they teach science either "quite a lot" or "a great deal" also is shown next to each graph. In most countries, the challenge of dealing with students of differing academic abilities is mentioned most often, with Greece, Hungary, Iceland, and Iran in the lead. Since tracking or streaming is relatively rare in the primary grades, it is perhaps not surprising that many teachers reported that the differing academic abilities of their students limited how they teach science. Also mentioned frequently as limiting factors were disruptive students (Iceland, Korea, and Portugal), and, in some countries, the burden of dealing with students with special needs (Greece, Hungary, Iceland, Iran, Kuwait, and Portugal). Inadequate physical facilities, and shortage of equipment for use in demonstrations, were reported to limit teaching in Greece, Iran, Kuwait, Latvia (LSS), and Thailand.

In some countries, large classes and high student/teacher ratios cause problems for teachers in carrying out their professional duties. The majority of students in almost half the countries (Australia, Greece, Iceland, Iran, Ireland, Korea, Kuwait, New Zealand, Portugal, and Slovenia) were taught by teachers who reported that high student/teacher ratios limited their teaching approach. Even among the other countries, however, only the teachers in Austria and Latvia (LSS) reported that student/teachers ratios affected instruction for fewer than 20% of the students.

Table 5.9 presents teachers' reports about the size of fourth-grade science classes for the TIMSS countries. The data reveal rather large variations from country to country. Norway had the smallest fourth-grade science classes, with an average of 19 students per class and 57% of students in classes of 20 or fewer students. According to teachers, science classes were relatively small in a number of countries. The average number of students in class was 25 or fewer in 13 countries. For example, 90% or more of the students were in science classes of 30 or fewer students in Austria, Canada, the Czech Republic, Greece, Hungary, Iceland, Latvia (LSS), Norway, Portugal, Slovenia, and the United States. At the other end of the spectrum, the average size of science classes in Korea was 43 students, and 69% of the students in that country were in science classes with more than 40 students. In Hong Kong, Japan, Korea, and Singapore, more than two-thirds of the students were in classes with more than 30 students (more than 90% in Korea and Singapore).

Figure 5.2

Teachers' Reports on What Factors Limit How They Teach Class Science - Upper Grade (Fourth Grade*)

Country	Percent of Students Whose Teachers Report Each Factor Limiting How They Teach Class "Quite A Lot" or "A Great Deal"					
	Students with Different Academic Abilities	Students with Special Needs	Disruptive Students	Shortage of Equipment for Use in Demonstrations and Other Exercises	Inadequate Physical Facilities	High Student Teacher Ratio
Australia	r 45	r 27	r 38	r 31	r 24	r 51
Austria	47	1	10	7	7	15
Canada	49	27	47	30	26	45
Czech Republic	r 64	r 23	r 40	r 48	r 28	r 38
Greece	81	r 60	44	r 65	50	64
Hungary	r 93	s 55	s 42	r 47	s 38	r 47
Iceland	86	r 53	55	r 50	r 46	68
Iran, Islamic Rep.	81	75	45	79	55	58
Ireland	69	28	37	28	20	54
Japan	60	-	-	28	-	41

Percent for "Quite a Lot" or "A Great Deal" →

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available.
Countries where data were not available or where teacher response data were available for <50% of students are omitted from figure (Cyprus, England, Hong Kong, Israel, and Singapore).
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.2 (Continued)

Teachers' Reports on What Factors Limit How They Teach Class Science - Upper Grade (Fourth Grade*)

Country	Percent of Students Whose Teachers Report Each Factor Limiting How They Teach Class "Quite A Lot" or "A Great Deal"					
	Students with Different Academic Abilities	Students with Special Needs	Disruptive Students	Shortage of Equipment for Use in Demonstrations and Other Exercises	Inadequate Physical Facilities	High Student/Teacher Ratio
Korea	69	41	64	54	27	62
Kuwait	s 65	s 58	s 49	s 73	s 53	s 81
Latvia (LSS)	30	13	22	77	64	13
Netherlands	63	21	31	18	19	r 35
New Zealand	45	26	27	31	25	59
Norway	r 56	r 34	r 25	r 38	r 13	r 45
Portugal	74	66	74	59	23	r 53
Scotland	63	32	31	11	21	39
Slovenia	24	16	50	61	46	52
Thailand	r 70	r 44	r 21	r 71	r 65	r 50
United States	r 41	r 19	r 32	r 24	r 15	r 39

Percent for "Quite a Lot" or "A Great Deal" →

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are not available.
Countries where data were not available or where teacher response data were available for <50% of students are omitted from figure (Cyprus, England, Hong Kong, Israel, and Singapore).
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.9

Teachers' Reports on Average Size of Science Class Upper Grade (Fourth Grade*)

Country	1 - 20 Students		21 - 30 Students		31 - 40 Students		41 or More Students		Average Number of Students
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	
Australia	r 17 (3.1)	582 (5.3)	64 (4.9)	558 (5.3)	19 (4.8)	555 (9.2)	0 (0.0)	~ ~	r 25 (0.6)
Austria	50 (5.0)	572 (5.8)	50 (5.0)	557 (4.2)	0 (0.0)	~ ~	0 (0.0)	~ ~	20 (0.5)
Canada	21 (3.0)	567 (8.0)	72 (3.0)	547 (2.8)	7 (1.4)	549 (8.6)	0 (0.2)	~ ~	24 (0.4)
Cyprus	x x	x x	x x	x x	x x	x x	x x	x x	x x
Czech Republic	32 (3.6)	544 (4.5)	65 (3.7)	560 (3.5)	3 (1.4)	636 (38.0)	0 (0.0)	~ ~	22 (0.4)
England	9 (2.7)	559 (13.7)	53 (4.9)	549 (5.2)	38 (5.0)	557 (6.5)	0 (0.0)	~ ~	28 (0.5)
Greece	45 (3.9)	496 (6.0)	53 (4.0)	499 (5.3)	2 (1.1)	~ ~	0 (0.0)	~ ~	21 (0.4)
Hong Kong	0 (0.4)	~ ~	13 (4.2)	516 (19.0)	74 (4.9)	536 (4.5)	13 (3.2)	559 (7.3)	36 (0.5)
Hungary	40 (3.6)	517 (5.6)	55 (3.9)	542 (4.2)	5 (2.1)	539 (17.4)	0 (0.0)	~ ~	22 (0.4)
Iceland	45 (4.9)	503 (4.5)	55 (4.9)	510 (5.1)	0 (0.0)	~ ~	0 (0.0)	~ ~	20 (0.4)
Iran, Islamic Rep.	17 (3.7)	379 (8.4)	24 (3.9)	413 (5.9)	38 (4.2)	436 (7.5)	21 (3.7)	430 (8.0)	32 (0.9)
Ireland	27 (2.8)	539 (5.5)	33 (4.3)	536 (6.9)	41 (4.7)	546 (4.6)	0 (0.0)	~ ~	26 (0.6)
Israel	r 7 (2.9)	512 (18.8)	46 (5.5)	502 (6.3)	46 (6.0)	499 (6.3)	0 (0.0)	~ ~	r 30 (0.6)
Japan	3 (0.8)	577 (7.8)	29 (3.5)	570 (3.2)	67 (3.6)	575 (2.2)	1 (1.1)	~ ~	32 (0.4)
Korea	2 (1.0)	~ ~	6 (1.6)	574 (6.4)	24 (3.6)	590 (3.9)	69 (3.5)	602 (2.5)	43 (0.6)
Kuwait	s 0 (0.0)	~ ~	39 (5.2)	404 (7.1)	58 (4.9)	402 (5.5)	3 (2.2)	405 (15.3)	s 32 (0.4)
Latvia (LSS)	51 (4.1)	506 (7.6)	45 (3.8)	520 (7.5)	3 (1.6)	517 (17.7)	1 (0.9)	~ ~	21 (0.8)
Netherlands	29 (4.0)	558 (4.7)	52 (5.5)	552 (5.0)	19 (4.4)	567 (4.8)	0 (0.0)	~ ~	24 (0.7)
New Zealand	13 (2.4)	539 (9.0)	37 (4.2)	516 (9.8)	50 (4.4)	543 (6.0)	0 (0.0)	~ ~	29 (0.5)
Norway	57 (4.6)	528 (4.5)	43 (4.6)	527 (6.0)	0 (0.0)	~ ~	0 (0.0)	~ ~	19 (0.5)
Portugal	39 (3.8)	475 (7.3)	60 (3.7)	481 (5.1)	1 (0.6)	~ ~	0 (0.0)	~ ~	21 (0.4)
Scotland	15 (2.3)	553 (6.4)	70 (3.5)	531 (5.6)	14 (3.3)	540 (7.0)	1 (1.0)	~ ~	26 (0.5)
Singapore	0 (0.0)	~ ~	2 (0.8)	~ ~	68 (3.3)	542 (5.5)	30 (3.2)	566 (10.5)	39 (0.2)
Slovenia	32 (4.5)	537 (6.7)	68 (4.5)	548 (3.8)	0 (0.0)	~ ~	0 (0.0)	~ ~	23 (0.4)
Thailand	28 (4.2)	477 (5.3)	29 (5.0)	478 (11.2)	36 (5.7)	478 (11.9)	7 (5.2)	438 (2.7)	28 (2.0)
United States	r 23 (3.5)	563 (7.0)	67 (3.7)	575 (4.0)	9 (1.7)	527 (9.3)	1 (0.5)	~ ~	r 24 (0.4)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
A tilde (~) indicates insufficient data to report achievement.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.
An "x" indicates teacher response data available for <50% students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Extensive research about class size in relation to achievement indicates that the existence of such a relationship is dependent on the situation. Dramatic reductions in class size can be related to gains in achievement, but the chief effects of smaller classes often are in relation to teacher attitudes and instructional behaviors. The TIMSS data illustrate the complexity of this issue. Across countries, two of the three highest-performing countries at the fourth grade – Korea and Japan – are among those with the largest science classes. Within countries, several show little or no relationship between achievement and class size, sometimes because students are almost all in classes of similar size. Within others, there appears to be a curvilinear relationship, or the students with higher achievement appear to be in larger classes. In some countries, larger classes may represent the more usual situation for teaching science, with smaller classes used primarily for students needing remediation or for students in the less-advanced tracks.

Teachers can adopt a variety of organizational and interactive approaches in science class. Whole-class instruction can be very efficient, because it requires less time on management functions and provides more time for developing science concepts. Teachers can make presentations, conduct discussions, or demonstrate procedures and applications to all students simultaneously. Both whole-class and independent work have been standard features of science classrooms. Students also can benefit from the type of cooperative learning that occurs with effective use of small-group work. Because they can help each other, students in groups can often handle challenging situations beyond their individual capabilities. Further, the positive affective impact of working together mirrors the use of science in the workplace.

Figure 5.3 provides a pictorial view of the emphasis on individual, group, and whole-class work as reported by the science teachers in the TIMSS countries. Because learning may be enhanced with teacher guidance and monitoring of individual and small-group activities, the frequency of lessons using each of these organizational approaches is shown both with and without assistance from the teacher. Internationally, teachers reported that working together as a class with the teacher teaching the whole class is a frequently used instructional approach. In more than half of the countries, 50% or more of the fourth-grade students were taught this way during most or all lessons. Students working individually with assistance from the teacher is also a popular approach, as is working in pairs or small groups with teacher assistance. Working without teacher assistance is less common in most countries. Working together as a class with students responding to one another was a common approach in Japan, Korea, and the Netherlands.

Figure 5.3

Teachers' Reports About Classroom Organization During Science Lessons Upper Grade (Fourth Grade*)

Country	Percent of Students Whose Teachers Report Using Each Organizational Approach "Most or Every Lesson"					
	Work Together as a Class with Students Responding to One Another	Work Together as a Class with Teacher Teaching the Whole Class	Work Individually with Assistance from Teacher	Work Individually without Assistance from Teacher	Work in Pairs or Small Groups with Assistance from Teacher	Work in Pairs or Small Groups without Assistance from Teacher
Australia	r 15	r 24	r 12	r 6	r 28	r 19
Austria	5	47	28	5	23	12
Canada	21	36	18	5	35	14
Czech Republic	r 22	r 64	r 32	r 25	r 8	r 8
England	18	17	14	4	34	7
Greece	r 8	r 71	r 39	r 8	r 21	r 4
Hong Kong	15	67	22	0	11	0
Hungary	19	77	43	8	16	4
Iceland	r 1	r 29	r 26	r 2	r 17	r 6
Iran, Islamic Rep.	32	61	59	5	41	5
Ireland	15	59	14	7	5	2
Israel	r 30	r 42	r 40	r 21	r 37	r 23
Japan	51	68	18	4	24	12

Percent for "Most or Every Lesson" →

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age-grade specifications, or classroom sampling procedures (see Figure A.3).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
Cyprus omitted from the figure; teacher response data available for <50% of students.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.3 (Continued)

Teachers' Reports About Classroom Organization During Science Lessons
Upper Grade (Fourth Grade*)

Country	Percent of Students Whose Teachers Report Using Each Organizational Approach "Most or Every Lesson"					
	Work Together as a Class with Students Responding to One Another	Work Together as a Class with Teacher Teaching the Whole Class	Work Individually with Assistance from Teacher	Work Individually without Assistance from Teacher	Work in Pairs or Small Groups with Assistance from Teacher	Work in Pairs or Small Groups without Assistance from Teacher
Korea	49	59	64	17	65	24
Kuwait	s 9	s 48	s 52	s 6	s 56	s 8
Latvia (LSS)	39	91	60	35	23	12
Netherlands	47	75	17	9	8	9
New Zealand	28	18	21	14	39	20
Norway	r 38	r 57	r 20	r 1	r 19	r 6
Portugal	20	65	54	12	42	12
Scotland	r 5	r 15	r 5	r 4	r 29	r 7
Singapore	21	67	51	15	43	18
Slovenia	13	53	64	35	36	26
Thailand	r 6	r 49	r 41	r 8	r 34	r 13
United States	r 35	r 47	r 20	r 6	r 26	r 10

Percent for "Most or Every Lesson" →

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3).
Cyprus omitted from the figure; teacher response data available for <50% of students.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Appendix A

Overview of TIMSS Procedures: Science Achievement Results for Third- and Fourth-Grade Students

History

TIMSS represents the continuation of a long series of studies conducted by the International Association for the Evaluation of Educational Achievement (IEA). Since its inception in 1959, the IEA has conducted more than 15 studies of cross-national achievement in curricular areas such as mathematics, science, language, civics, and reading. IEA conducted its First International Science Study (FISS) in 1970-71, and the Second International Science Study (SISS) in 1983-84. The First and Second International Mathematics Studies (FIMS and SIMS) were conducted in 1964 and 1980-82, respectively. Since the subjects of mathematics and science are related in many respects, the third studies were conducted together as an integrated effort.[1]

The number of participating countries, the number of grades tested, and the inclusion of both mathematics and science resulted in TIMSS becoming the largest, most complex IEA study to date and the largest international study of educational achievement ever undertaken. Traditionally, IEA studies have systematically worked toward gaining more in-depth understanding of how various factors contribute to the overall outcomes of schooling. Particular emphasis has been given to refining our understanding of students' opportunity to learn as this opportunity becomes successively defined and implemented by curricular and instructional practices. In an effort to extend what had been learned from previous studies and provide contextual and explanatory information, the magnitude of TIMSS expanded beyond the already substantial task of measuring achievement in two subject areas to also include a thorough investigation of curriculum and how it is delivered in classrooms around the world.

The Components of TIMSS

Continuing the approach of previous IEA studies, TIMSS addressed three conceptual levels of curriculum. The **intended curriculum** is composed of the mathematics and science instructional and learning goals as defined at the system level. The **implemented curriculum** is the mathematics and science curriculum as interpreted by

teachers and made available to students. The **attained curriculum** is the mathematics and science content that students have learned and their attitudes towards these subjects. To aid in meaningful interpretation and comparison of results, TIMSS also collected extensive information about the social and cultural contexts for learning, many of which are related to variations among different educational systems.

Nearly 50 countries participated in one or more of the various components of the TIMSS data collection effort, including the curriculum analysis. To gather information about the intended curriculum, mathematics and science specialists within each participating country worked section by section through curriculum guides, textbooks, and other curricular materials to categorize aspects of these materials in accordance with detailed specifications derived from the TIMSS mathematics and science curriculum frameworks.[2] Initial results from this component of TIMSS can be found in two companion volumes: *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intention in School Mathematics* and *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Science.*[3]

To measure the attained curriculum, TIMSS tested more than half a million students in mathematics and science at five grade levels. TIMSS included testing at three separate populations:

Population 1. Students enrolled in the two adjacent grades that contained the largest proportion of 9-year-old students at the time of testing – third and fourth grade in most countries.

Population 2. Students enrolled in the two adjacent grades that contained the largest proportion of 13-year-old students at the time of testing – seventh and eighth grade in most countries.

Population 3. Students in their final year of secondary education. As an additional option, countries could test two special subgroups of these students:

1) Students taking advanced courses in mathematics, and
2) Students taking physics.

Countries participating in the study were required to administer tests to the students in the two grades at Population 2, but could choose whether or not to participate at the other levels. In about half of the countries at Populations 1 and 2, subsets of the upper-grade students who completed the written tests also participated in a performance assessment. In the performance assessment, students engaged in a number of hands-on mathematics and science activities. The students designed experiments, tested hypotheses, and recorded their findings. For example, in one task, students

Robitaille, D.F., McKnight, C., Schmidt, W., Britton, E., Raizen, S., and Nicol, C. (1993). *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science.* Vancouver, B.C.: Pacific Educational Press.

Schmidt, W.H., McKnight, C.C., Valverde, G.A., Houang, R.T., and Wiley, D.E. (1997). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Mathematics.* Dordrecht, the Netherlands: Kluwer Academic Publishers. Schmidt, W.H., Raizen, S.A., Britton, E.D., Bianchi, L.J., and Wolfe, R.G. (in press). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Science.* Dordrecht, the Netherlands: Kluwer Academic Publishers.

were asked to design and conduct a controlled experiment to measure the effect of water temperature on the rate at which tablets dissolve, requiring organization and interpretation of data to draw conclusions and explain results. Figure A.1 shows the countries that participated in the various components of TIMSS achievement testing.

TIMSS also administered a broad array of questionnaires to collect data about how the curriculum is implemented in classrooms, including the instructional practices used to deliver it. The questionnaires also were used to collect information about the social and cultural contexts for learning. Questionnaires were administered at the country level about decision-making and organizational features within their educational systems. The students who were tested answered questions pertaining to their attitudes towards mathematics and science, classroom activities, home background, and out-of-school activities. The mathematics and science teachers of sampled students responded to questions about teaching emphasis on the topics in the curriculum frameworks, instructional practices, textbook use, professional training and education, and their views on mathematics and science. The heads of schools responded to questions about school staffing and resources, mathematics and science course offerings, and teacher support. In addition, a volume was compiled that presents descriptions of the educational systems of the participating countries.[4]

With its enormous array of data, TIMSS has numerous possibilities for policy-related research, focused studies related to students' understandings of mathematics and science subtopics and processes, and integrated analyses linking the various components of TIMSS. The initial round of reports is only the beginning of a number of research efforts and publications aimed at increasing our understanding of how mathematics and science education functions across countries, investigating what impacts student performance, and helping to improve mathematics and science education.

[4] Robitaille, D.F. (Ed.) (1997). *National Contexts for Mathematics and Science Education: An Encyclopedia of the Education Systems Participating in TIMSS*. Vancouver, B.C.: Pacific Educational Press.

Figure A.1

Countries Participating in Components of TIMSS Testing

Country	Population 1		Population 2		Population 3		
	Written Test	Performance Assessment	Written Test	Performance Assessment	Mathematics & Science Literacy	Advanced Mathematics	Physics
Argentina			●				
Australia	●	●	●	●	●	●	●
Austria	●		●		●	●	●
Belgium (Fl)			●				
Belgium (Fr)			●				
Bulgaria			●				
Canada	●	●	●	●	●	●	●
Colombia			●	●			
Cyprus	●	●	●	●	●	●	●
Czech Republic	●	●	●	●	●	●	●
Denmark			●	●	●	●	●
England	●		●	●			
France			●		●	●	●
Germany			●		●	●	●
Greece	●		●			●	
Hong Kong	●	●	●	●			
Hungary	●		●		●		
Iceland	●		●		●		
Indonesia	●		●				
Iran, Islamic Rep.	●	●	●	●			
Ireland	●		●				
Israel	●	●	●	●	●	●	●
Italy	●		●		●		
Japan	●		●				
Korea	●		●				
Kuwait	●		●				
Latvia	●		●				●
Lithuania			●		●	●	
Mexico	●		●		●	●	●
Netherlands	●		●	●	●		
New Zealand	●	●	●	●	●		
Norway	●		●	●	●		●
Philippines			●				
Portugal	●	●	●	●			
Romania			●	●			
Russian Federation			●		●	●	●
Scotland	●		●	●			
Singapore	●		●	●			
Slovak Republic			●				
Slovenia	●	●	●	●	●	●	●
South Africa			●		●		
Spain			●	●			
Sweden			●	●	●	●	●
Switzerland			●	●	●	●	●
Thailand	●		●				
United States	●	●	●	●	●	●	●

Developing the TIMSS Science Test

The TIMSS curriculum framework underlying the science tests at all three populations was developed by groups of science educators with input from the TIMSS National Research Coordinators (NRCs). As shown in Figure A.2, the science curriculum framework contains three dimensions or aspects. The content aspect represents the subject matter content of school science. The performance expectations aspect describes, in a non-hierarchical way, the many kinds of performances or behaviors that might be expected of students in school science. The perspectives aspect focuses on the development of students' attitudes, interest, and motivations in science.[3]

Working within the science curriculum framework, science test specifications were developed for each population that included items representing a wide range of science topics and eliciting a range of skills from the students. The tests were developed through an international consensus involving input from experts in science and measurement specialists. The TIMSS Subject Matter Advisory Committee, including distinguished scholars from 10 countries, ensured that the test reflected current thinking and priorities in the sciences. The items underwent an iterative development and review process, with one of the pilot testing efforts involving 43 countries. Every effort was made to help ensure that the tests represented the curricula of the participating countries and that the items did not exhibit any bias towards or against particular countries, including modifying specifications in accordance with data from the curriculum analysis component, obtaining ratings of the items by subject-matter specialists within the participating countries, and conducting thorough statistical item analysis of data collected in the pilot testing. The final forms of the test were endorsed by the NRCs of the participating countries.[4] In addition, countries had an opportunity to match the content of the test to their curricula at the third and fourth grades. They identified items measuring topics not covered in their intended curriculum. The information from this Test-Curriculum Matching Analysis indicates that omitting such items has little effect on the overall pattern of results (see Appendix B).

Table A.1 presents the five content areas included in the Population 1 science test and the numbers of items and score points in each category. Distributions also are included for the five performance categories derived from the performance expectations aspect of the curriculum framework. Approximately one-fourth of the items were in the free-response format, requiring students to generate and write their own answers. Designed to represent approximately one-third of students' response time,

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some free-response questions asked for short answers while others required extended responses where students needed to show their work or provide explanations for their answers. The remaining questions used a multiple-choice format. In scoring the tests, correct answers to most questions were worth one point. Consistent with the approach of allotting students longer response time for the constructed-response questions than for multiple-choice questions, however, responses to some of these questions (particularly those requiring extended responses) were evaluated for partial credit, with a fully correct answer being awarded two points (see later section on scoring). This, in addition to the fact that several items had two parts, means that the total number of score points available for analysis somewhat exceeds the number of items included in the test.

The TIMSS instruments were prepared in English and translated into the additional languages used for testing. In addition, it sometimes was necessary to adapt the international versions for cultural purposes, including the countries that tested in English. This process represented an enormous effort for the national centers, with many checks along the way. The translation effort included: 1) developing explicit guidelines for translation and cultural adaptation, 2) translation of the instruments by the national centers in accordance with the guidelines and using two or more independent translations, 3) consultation with subject-matter experts regarding cultural adaptations to ensure that the meaning and difficulty of items did not change, 4) verification of the quality of the translations by professional translators from an independent translation company, 5) corrections by the national centers in accordance with the suggestions made, 6) verification that corrections were implemented, and 7) a series of statistical checks after the testing to detect items that did not perform comparably across countries.[7]

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[7] More details about the translation verification procedures can be found in Mullis, I.V.S., Kelly, D.L., and Haley, K. (1996). "Translation Verification Procedures," in M.O. Martin and I.V.S. Mullis (Eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection*. Chestnut Hill, MA: Boston College; and Maxwell, B. (1996). "Translation and Cultural Adaptation of the TIMSS Instruments," in M.O. Martin and D.L. Kelly (Eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.

Figure A.2

The Three Aspects and Major Categories of the Science Framework

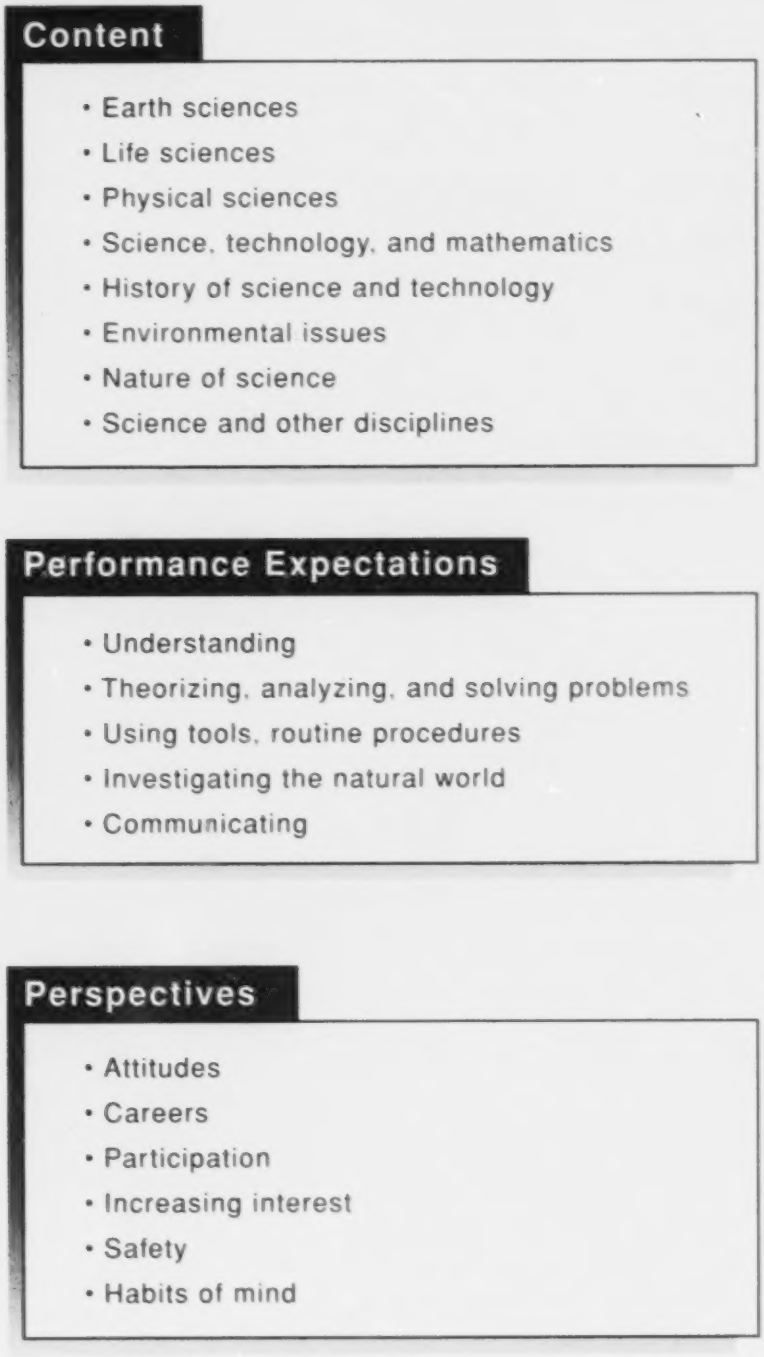

Table A.1

Distribution of Science Items by Content Reporting Category and Performance Expectation - Population 1

Content Category	Percentage of Items	Number of Items	Number of Multiple-Choice Items	Number of Short-Answer Items	Number of Extended-Response Items	Number of Score Points[1]
Earth Science	18%	17	13	2	2	18
Life Science	42%	41	33	5	3	43
Physical Science	31%	30	23	4	3	33
Environmental Issues and the Nature of Science	9%	9	5	2	2	11
Total	100%	97	74	13	10	105

Performance Expectation	Percentage of Items	Number of Items	Number of Multiple-Choice Items	Number of Short-Answer Items	Number of Extended-Response Items	Number of Score Points[1]
Understanding Simple Information	45%	44	42	1	1	44
Understanding Complex Information	31%	30	21	5	4	34
Theorizing, Analyzing and Solving Problems	14%	14	3	6	5	18
Using Tools, Routine Procedures, and Science Processes	6%	6	5	1	0	6
Investigating the Natural World	3%	3	3	0	0	3

[1] In scoring the tests correct answers to most items were worth one point. However, responses to some constructed response items were evaluated for partial credit with a fully correct answer awarded up to two points. In addition, some items had two parts. Thus, the number of score points exceeds the number of items in the test.

Because results are rounded to the nearest whole number some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

TIMSS Test Design

Not all of the students in Population 1 responded to all of the science items. To ensure broad subject matter coverage without overburdening individual students, TIMSS used a rotated design that included both the mathematics and science items. Thus, the same students participated in both the mathematics and science testing. The TIMSS Population 1 test consisted of eight booklets, with each booklet requiring 64 minutes of student response time. The booklets were designed to be administered in two consecutive testing sessions with a 15- to 20-minute break in between. Students took four clusters of items (37 minutes) prior to the break and three clusters of items (27 minutes) after the break. In accordance with the design, the mathematics and science items were assembled into 26 different clusters (labeled A through Z). Cluster A was designed to take students 10 minutes to complete and the remaining clusters were designed to take 9 minutes each. In all, the design provided a total of 235 unique testing minutes, 118 for mathematics and 117 for science. Cluster A was a core cluster assigned to all booklets. The remaining clusters were assigned to the booklets in accordance with the rotated design so that representative samples of students responded to each cluster.[2]

Sample Implementation and Participation Rates

The selection of valid and efficient samples is crucial to the quality and success of an international comparative study such as TIMSS. The accuracy of the survey results depends on the quality of the available sampling information and on the quality of the sampling activities themselves. For TIMSS, NRCs worked on all phases of sampling with staff from Statistics Canada. NRCs received training in how to select the school and student samples and in the use of the sampling software. In consultation with the TIMSS sampling referee (Keith Rust, Westat, Inc.), staff from Statistics Canada reviewed the national sampling plans, sampling data, sampling frames, and sample execution. This documentation was used by the International Study Center in consultation with Statistics Canada, the sampling referee, and the Technical Advisory Committee to evaluate the quality of the samples.

In a few situations where it was not possible to implement TIMSS testing for all of Population 1, as specified by the international desired definition (all students in the two adjacent grades with the greatest proportion of 9-year-olds), countries were permitted to define a national desired population that did not include part of the international desired population. Table A.2 shows any differences in coverage between the international and national desired populations. Most participants achieved 100% coverage (24 out of 26). The countries with less than 100% coverage are annotated in tables in this report. Israel and Latvia, as a matter of practicality, needed to define

[2] The design is fully documented in Adams, R. and Gonzalez, E. (1996). "Design of the TIMSS Achievement Instruments." In D.F. Robitaille and R.A. Garden (Eds.), *TIMSS Monograph No. 2: Research Questions and Study Design*. Vancouver, B.C.: Pacific Educational Press; and Adams, R. and Gonzalez, E. (1996). "TIMSS Test Design." In M.O. Martin and D.L. Kelly (Eds.), *Third International Mathematics and Science Study Technical Report, Volume I: Design and Development*. Chestnut Hill, MA: Boston College.

their tested population according to the structure of their school systems. Because coverage fell below 65% for Latvia, the Latvian results have been labeled "Latvia (LSS)," for Latvian Speaking Schools, throughout the report.

Within the desired population, countries could define a population that excluded a small percentage (less than 10%) of certain kinds of schools or students that would be very difficult or resource intensive to test (e.g., schools for students with special needs or schools that were very small or located in extremely remote areas). Table A.2 also shows that the degree of such exclusions was small. Only England exceeded the 10% limit, and this is annotated in the tables in this report. This primarily was because schools which were taking part in trials for National Curriculum Assessment (5.8 % of students) were excluded.

Countries were required to test the two adjacent grades with the greatest proportion of 9-year-olds. Table A.3 presents, for each country, the percentage of 9-year-olds in the lower grade tested, the percentage in the upper grade, and the percentage in the upper and lower grades combined.

Within countries, TIMSS used a two-stage sample design at Population 1, where the first stage involved selecting 150 public and private schools within each country. Within each school, the basic approach required countries to use random procedures to select one mathematics class at the fourth grade and one at the third grade (or the corresponding upper and lower grades in that country). All of the students in those two classes were to participate in the TIMSS testing. This approach was designed to yield a representative sample of 7,500 students per country, with approximately 3,750 students at each grade.[9] Typically, between 450 and 3,750 students responded to each item at each grade level, depending on the booklets in which the items were located.

Countries were required to obtain a participation rate of at least 85% of both schools and students, or a combined rate (the product of school and student participation) of 75%. Tables A.4 through A.8 present the participation rates and achieved sample sizes for the fourth and third grades.

[9] The sample design for TIMSS is described in detail in Foy, P., Rust, K. and Schleicher, A. (1996). "TIMSS Sample Design" in M.O. Martin and D.L. Kelly (Eds.), *Third International Mathematics and Science Study Technical Report, Volume I.* Chestnut Hill, MA: Boston College.

Table A.2

Coverage of TIMSS Target Population

The International Desired Population is defined as follows:
Population 1 - All students enrolled in the two adjacent grades with the largest proportion of 9-year-old students at the time of testing.

Country	International Desired Population		National Desired Population		
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Australia	100%		0.1%	1.6%	1.8%
Austria	100%		2.6%	0.2%	2.8%
Canada	100%		2.5%	3.6%	6.2%
Cyprus	100%		3.1%	0.1%	3.2%
Czech Republic	100%		4.1%	0.0%	4.1%
[2] England	100%		8.6%	3.5%	12.1%
Greece	100%		1.5%	4.0%	5.4%
Hong Kong	100%		2.6%	0.0%	2.7%
Hungary	100%		3.8%	0.0%	3.8%
Iceland	100%		1.9%	4.3%	6.2%
Iran, Islamic Rep.	100%		0.3%	1.0%	1.3%
Ireland	100%		5.3%	1.6%	6.9%
[1] Israel	72%	Hebrew Public Education System	1.1%	0.1%	1.2%
Japan	100%		3.0%	0.0%	3.0%
Korea	100%		3.9%	2.6%	6.6%
Kuwait	100%		0.0%	0.0%	0.0%
[1] Latvia (LSS)	60%	Latvian-speaking schools	2.1%	0.0%	2.1%
Netherlands	100%		4.0%	0.4%	4.4%
New Zealand	100%		0.7%	0.6%	1.3%
Norway	100%		1.1%	2.0%	3.1%
Portugal	100%		6.6%	0.7%	7.3%
Scotland	100%		2.4%	4.3%	6.7%
Singapore	100%		0.0%	0.0%	0.0%
Slovenia	100%		1.9%	0.0%	1.9%
Thailand	100%		6.8%	1.5%	8.3%
United States	100%		0.4%	4.3%	4.7%

National Desired Population does not cover all of International Desired Population. Because coverage falls below 65%.
Latvia is annotated LSS for Latvian Speaking Schools only.
[1] National Defined Population covers less than 90 percent of National Desired Population.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.3

Coverage of 9-Year-Old Students

Country	Percent of 9-Year-Olds in Lower Grade (Third Grade*)	Percent of 9-Year-Olds in Upper Grade (Fourth Grade*)	Percent of 9-Year-Olds in Both Grades
Australia	65	29	94
Austria	72	15	87
Canada	46	48	94
Cyprus	35	63	98
Czech Republic	75	15	91
England	58	41	99
Greece	11	88	99
Hong Kong	43	50	93
Hungary	70	19	89
Iceland	15	84	99
Iran, Islamic Rep.	51	32	83
Ireland	68	23	92
Israel	–	–	–
Japan	91	9	99
Korea	67	24	91
Kuwait	–	–	–
Latvia (LSS)	55	21	76
Netherlands	63	30	93
New Zealand	50	49	99
Norway	38	62	100
Portugal	45	48	93
Scotland	23	76	99
Singapore	80	17	98
Slovenia	60	0	60
Thailand	60	11	71
United States	61	34	95

*Third and fourth grades in most countries; see Table 2 for more information about the grades tested in each country.
A dash (–) indicates data are unavailable. Israel and Kuwait did not test the lower grade.
Because results are rounded to the nearest whole number some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.4

School Participation Rates and Sample Sizes

Upper Grade (Fourth Grade*)

Country	School Participation Before Replacement (Weighted Percentage)	School Participation After Replacement (Weighted Percentage)	Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of Schools in Original Sample That Participated	Number of Replacement Schools That Participated		Total Number of Schools That Participated
						Procedural	Other	
Australia	66	69	268	268	169	9	0	178
Austria	51	72	150	150	71	31	31	133
Canada	90	90	423	420	390	0	0	390
Cyprus	97	97	150	150	146	0	0	146
Czech Republic	91	94	215	215	181	7	0	188
England	63	88	150	145	92	35	0	127
Greece	93	93	187	187	174	0	0	174
Hong Kong	84	84	156	148	124	0	0	124
Hungary	100	100	150	150	150	0	0	150
Iceland	95	95	153	151	144	0	0	144
Iran, Islamic Rep.	100	100	180	180	180	0	0	180
Ireland	94	96	175	173	161	4	0	165
Israel	40	40	100	100	40	0	47	87
Japan	93	96	150	150	137	4	0	141
Korea	100	100	150	150	150	0	0	150
Kuwait	100	100	150	150	150	0	0	150
Latvia (LSS)	74	74	169	169	125	0	0	125
Netherlands	31	62	196	196	63	67	0	130
New Zealand	80	99	150	150	120	29	0	149
Norway	85	94	150	148	126	13	0	139
Portugal	95	95	150	150	143	0	0	143
Scotland	78	83	184	184	143	9	0	152
Singapore	100	100	191	191	191	0	0	191
Slovenia	81	81	150	150	121	0	0	121
Thailand	96	96	155	155	154	0	0	154
United States	85	85	220	213	182	0	0	182

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
Replacement schools selected in accordance with the TIMSS sampling procedures are listed in the "procedural" column. Those selected using unapproved methods are listed in the "other" column and were not included in the computation of school participation rates.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.5

Student Participation Rates and Sample Sizes

Upper Grade (Fourth Grade*)

Country	Within School Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class School	Number of Students Excluded	Number of Students Eligible	Number of Students Absent	Total Number of Students Assessed
Australia	96	6930	37	104	6789	282	6507
Austria	96	2779	12	6	2761	116	2645
Canada	96	9193	81	268	8844	436	8408
Cyprus	86	3972	4	3	3965	589	3376
Czech Republic	92	3555	7	0	3548	280	3268
England	95	3489	73	122	3294	168	3126
Greece	95	3358	6	116	3236	183	3053
Hong Kong	98	4475	0	1	4474	63	4411
Hungary	92	3272	0	0	3272	266	3006
Iceland	90	2149	23	101	2025	216	1809
Iran, Islamic Rep.	97	3521	5	36	3480	95	3385
Ireland	93	3134	14	40	3080	207	2873
Israel	94	2486	0	3	2483	132	2351
Japan	97	4453	0	0	4453	147	4306
Korea	95	2971	133	0	2838	26	2812
Kuwait	95	4578	34	0	4544	226	4318
Latvia (LSS)	93	2390	12	1	2377	161	2216
Netherlands	96	2639	0	4	2635	111	2524
New Zealand	96	2627	82	20	2525	104	2421
Norway	97	2391	16	42	2333	76	2257
Portugal	96	2994	15	16	2963	110	2853
Scotland	92	3735	0	139	3596	295	3301
Singapore	98	7274	14	0	7260	121	7139
Slovenia	94	2720	3	0	2717	151	2566
Thailand	100	3042	0	50	2992	0	2992
United States	94	8224	61	412	7751	455	7296

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.6

School Participation Rates and Sample Sizes

Lower Grade (Third Grade*)

Country	School Participation Before Replacement (Weighted Percentage)	School Participation After Replacement (Weighted Percentage)	Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of Schools in Original Sample That Participated	Number of Replacement Schools That Participated		Total Number of Schools That Participated
						Procedural	Other	
Australia	66	69	268	264	166	9	0	175
Austria	49	70	150	149	68	29	31	128
Canada	88	88	423	418	375	0	0	375
Cyprus	98	98	150	150	147	0	0	147
Czech Republic	91	93	215	215	180	7	0	187
England	64	88	150	145	93	35	0	128
Greece	91	91	187	187	171	0	0	171
Hong Kong	84	84	156	147	123	0	0	123
Hungary	99	99	150	150	149	0	0	149
Iceland	95	95	153	152	144	0	0	144
Iran, Islamic Rep.	99	99	180	180	178	0	0	178
Ireland	94	96	175	173	160	4	0	164
Israel	-	-	-	-	-	-	-	-
Japan	93	95	150	150	137	5	0	142
Korea	100	100	150	150	150	0	0	150
Kuwait	-	-	-	-	-	-	-	-
Latvia (LSS)	73	73	169	168	123	0	0	123
Netherlands	29	62	196	195	60	69	0	129
New Zealand	80	99	150	150	120	29	0	149
Norway	83	92	150	148	124	12	0	136
Portugal	95	95	150	150	143	0	0	143
Scotland	77	81	184	184	142	8	0	150
Singapore	100	100	191	191	191	0	0	191
Slovenia	81	81	150	149	122	0	0	122
Thailand	96	96	155	154	153	0	0	153
United States	86	86	220	217	186	0	0	186

*Third grade in most countries; see Table 2 for more information about the grades tested in each country.
A dash (–) indicates data are unavailable. Israel and Kuwait did not test the lower grade.
Replacement schools selected in accordance with the TIMSS sampling procedures are listed in the "procedural" column. Those selected using unapproved methods are listed in the "other" column and were not included in the computation of school participation rates.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.7

Student Participation Rates and Sample Sizes

Lower Grade (Third Grade*)

Country	Within School Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn From Class/School	Number of Students Excluded	Number of Students Eligible	Number of Students Absent	Total Number of Students Assessed
Australia	95	5138	31	92	5015	274	4741
Austria	96	2655	10	6	2639	113	2526
Canada	96	8433	77	307	8049	455	7594
Cyprus	85	3913	5	2	3906	598	3308
Czech Republic	93	3484	8	0	3476	220	3256
England	94	3468	70	158	3240	184	3056
Greece	94	3263	4	133	3126	171	2955
Hong Kong	99	4455	0	2	4453	57	4396
Hungary	94	3270	0	0	3270	232	3038
Iceland	91	2017	19	89	1909	211	1698
Iran, Islamic Rep.	98	3504	12	49	3443	82	3361
Ireland	94	3127	14	39	3074	185	2889
Israel	–	–	–	–	–	–	–
Japan	97	4433	0	0	4433	127	4306
Korea	94	2969	138	2	2829	52	2777
Kuwait	–	–	–	–	–	–	–
Latvia (LSS)	94	2218	8	0	2210	156	2054
Netherlands	96	2923	0	14	2909	119	2790
New Zealand	95	2733	91	9	2633	129	2504
Norway	97	2362	8	59	2295	76	2219
Portugal	97	2790	13	31	2746	96	2650
Scotland	90	3663	0	187	3476	344	3132
Singapore	98	7223	14	0	7209	179	7030
Slovenia	95	2659	5	0	2654	133	2521
Thailand	100	2945	0	74	2871	1	2870
United States	95	4280	40	201	4039	220	3819

*Third grade in most countries; see Table 2 for more information about the grades tested in each country.
A dash (–) indicates data are unavailable. Israel and Kuwait did not test the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.8

Overall Participation Rates

Lower and Upper Grades (Third and Fourth Grades*)

Country	Upper Grade		Lower Grade	
	Overall Participation Before Replacement (Weighted Percentage)	Overall Participation After Replacement (Weighted Percentage)	Overall Participation Before Replacement (Weighted Percentage)	Overall Participation After Replacement (Weighted Percentage)
Australia	63	66	62	65
Austria	49	69	46	67
Canada	86	86	84	84
Cyprus	83	83	83	83
Czech Republic	84	86	85	87
England	60	83	61	83
Greece	88	88	86	86
Hong Kong	83	83	83	83
Hungary	92	92	93	93
Iceland	86	86	86	86
Iran, Islamic Rep.	97	97	97	97
Ireland	88	90	88	91
Israel	38	38	–	–
Japan	90	92	90	93
Korea	95	95	94	94
Kuwait	95	95	–	–
Latvia (LSS)	69	69	69	69
Netherlands	29	59	28	60
New Zealand	77	95	76	95
Norway	82	91	81	89
Portugal	92	92	92	92
Scotland	71	76	69	73
Singapore	98	98	98	98
Slovenia	76	76	77	77
Thailand	96	96	96	96
United States	80	80	81	81

*Third and Fourth grades in most countries; see Table 2 for information about the grades tested in each country.
A dash (–) indicates data are unavailable. Israel and Kuwait did not test the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95

Indicating Compliance with Sampling Guidelines in the Report

Figure A.3 shows how countries have been grouped in tables reporting achievement results. Countries that complied with the TIMSS guidelines for grade selection and classroom sampling, and that achieved acceptable participation rates, are shown in the first panel of Figure A.3. An acceptable participation rate was at least 85% of both the schools and students or a combined rate (the product of school and student participation) of 75% with or without replacement schools. Countries that met the guidelines only after including replacement schools are annotated. These countries (17 at the fourth grade and 16 at the third grade) appear in the tables in Chapters 1, 2, and 3 ordered by achievement.

Countries that did not reach at least 50% school participation without the use of replacement schools, or that failed to reach the sampling participation standard even with the inclusion of replacement schools, are shown in the second panel of Figure A.3. These countries are presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are shown in tables in Chapters 4 and 5 in italics.

To provide a better curricular match, Slovenia elected to test its third- and fourth-grade students even though that meant not testing the two grades with the most 9-year-olds and resulted in its students being somewhat older than those in the other countries. Slovenia is also presented in a separate section of the achievement tables in Chapters 1, 2, and 3 and is shown in tables in Chapters 4 and 5 in italics. Table A.3 shows the percentages of 9-year-olds for each country in the grades tested.

Hungary did not completely comply with the guidelines for sampling classrooms at the fourth grade and thus its results are also presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are italicized in tables in Chapters 4 and 5. At the fourth grade, Israel, Kuwait, and Thailand also had difficulty complying with the classroom selection guidelines, but in addition had other difficulties (Kuwait tested a single grade with relatively few 9-year-olds; Israel had low sampling participation rates; Thailand had a high percentage of older students), and so these countries are also presented in separate sections in tables in Chapters 1, 2, and 3, and are italicized in tables in Chapters 4 and 5. Israel and Kuwait did not test at the lower grade.

Figure A.3

Countries Grouped for Reporting of Achievement According to Their Compliance with Guidelines for Sample Implementation and Participation Rates

	Fourth Grade	Third Grade
Countries satisfying guidelines for sample participation rates, grade selection and sampling procedures	Canada Cyprus Czech Republic [1,2] England Greece Hong Kong Iceland Iran, Islamic Rep. Ireland Japan Korea New Zealand Norway Portugal [1] Scotland Singapore United States	Canada Cyprus Czech Republic [1,2] England Greece Hong Kong Iceland Iran, Islamic Rep. Ireland Japan Korea New Zealand Norway Portugal Singapore United States
Countries not satisfying guidelines for sample participation	Australia Austria [1] Latvia (LSS) Netherlands	Australia Austria [1] Latvia (LSS) Netherlands Scotland
Countries not meeting age/grade specifications (high percentage of older students)	Slovenia	Slovenia
Countries with unapproved sampling procedures at the classroom level	Hungary	Hungary
Countries with unapproved sampling procedures at classroom level and not meeting other guidelines	[1] Israel Kuwait Thailand	Thailand

[1] Met guidelines for sample participation rates only after replacement schools were included.
[2] National Desired Population does not cover all of International Desired Population (see Table 1).
Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
[3] National Defined Population covers less than 90 percent of National Desired Population (see Table 1).

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Data Collection

Each participating country was responsible for carrying out all aspects of the data collection, using standardized procedures developed for the study. Training manuals were developed for school coordinators and test administrators that explained procedures for receipt and distribution of materials as well as for the activities related to the testing sessions. The test administrator manuals covered procedures for test security, standardized scripts to regulate directions and timing, rules for answering students' questions, and steps to ensure that identification on the test booklets and questionnaires corresponded to the information on the forms used to track students.

Each country was responsible for conducting quality control procedures and describing this effort as part of the NRC's report documenting procedures used in the study. In addition, the International Study Center considered it essential to establish some method to monitor compliance with standardized procedures. NRCs were each asked to nominate a person, such as a retired school teacher, to serve as the quality control monitor for his or her own country, and in almost all cases, the International Study Center adopted the NRC's first suggestion. The International Study Center developed manuals for the quality control monitors and briefed them in two-day training sessions about TIMSS, the responsibilities of the national centers in conducting the study, and their own roles and responsibilities.

The quality control monitors interviewed the NRCs about data collection plans and procedures. They also selected a sample of approximately 10 schools to visit, where they observed testing sessions and interviewed school coordinators.[10] Quality control monitors observed test administrations and interviewed school coordinators in 37 countries, and interviewed school coordinators or test administrators in 3 additional countries.

The results of the interviews indicate that, in general, NRCs had prepared well for data collection and, despite the heavy demands of the schedule and shortages of resources, were in a position to conduct the data collection in an efficient and professional manner. Similarly, the TIMSS tests appeared to have been administered in compliance with international procedures, including the activities preliminary to the testing session, the activities during the testing sessions, and the school-level activities related to receiving, distributing, and returning materials from the national centers.

[10] The results of the interviews and observations by the quality control monitors are presented in Martin, M.O., Hoyle, C.D., and Gregory, K.D. (1996). "Monitoring the TIMSS Data Collection" and "Observing the TIMSS Test Administration," both in M.O. Martin and I.V.S. Mullis (Eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection*. Chestnut Hill, MA: Boston College.

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Scoring the Free-Response Items

Because approximately one-third of the written test time was devoted to free-response items, TIMSS needed to develop procedures for reliably evaluating student responses within and across countries. Scoring utilized two-digit codes with rubrics specific to each item. Development of the rubrics was led by the Norwegian TIMSS national center. The first digit designates the correctness level of the response. The second digit, combined with the first digit, represents a diagnostic code used to identify specific types of approaches, strategies, or common errors and misconceptions. Although not specifically used in this report, analyses of responses based on the second digit should provide insight into ways to help students better understand science concepts and problem-solving approaches.

To meet the goal of implementing reliable scoring procedures based on the TIMSS rubrics, the International Study Center prepared guides containing the rubrics and explanations of how to implement them, together with example student responses for the various rubric categories. These guides, together with more examples of student responses for practice in applying the rubrics, were used as a basis for an ambitious series of regional training sessions. The training sessions were designed to assist representatives of national centers who would then be responsible for training personnel in their respective countries to apply the two-digit codes reliably.[11]

To gather and document empirical information about the within-country agreement among scorers, TIMSS developed a procedure whereby systematic subsamples of approximately 10% of the students' responses were to be coded independently by two different readers. Table A.9 shows the average and range of the within-country percentage of exact agreement between scorers on the free-response items in the Population 1 science test for 16 countries. Unfortunately, lack of resources precluded several countries from providing this information. A high percentage of exact agreement was observed, with averages across the items for the correctness score ranging from 89% to 98% and an overall average of 94% across the 16 countries.

To provide information about the cross-country agreement among scorers, TIMSS conducted a special study at Population 2, where 39 scorers from 21 of the participating countries evaluated common sets of students' responses to more than half of the free-response items. Unfortunately, resources did not allow an international reliability study to be conducted for Population 1. However, the results of the international reliability study at Population 2 demonstrated a very high percentage of exact agreement on the correctness and diagnostic scores. The TIMSS data from the reliability studies indicate that scoring procedures were robust for the science items, especially for the correctness score used for the analyses in this report.[12]

Table A.9

TIMSS Within-Country Free-Response Coding Reliability Data for Population 1 Science Items*

Country	Correctness Score Agreement			Diagnostic Code Agreement		
	Average Percent of Exact Agreement Across Items	Range of Percent of Exact Agreement		Average Percent of Exact Agreement Across Items	Range of Percent of Exact Agreement	
		Min	Max		Min	Max
Australia	93	77	99	82	59	99
Canada	90	79	97	80	62	96
Czech Republic	95	82	100	91	77	100
England	97	93	100	91	83	99
Hong Kong	97	93	99	95	85	99
Ireland	96	91	100	91	85	99
Iran, Islamic Rep.	86	73	96	72	55	89
Israel	90	76	99	81	59	95
Japan	98	94	100	95	89	100
Netherlands	90	65	98	80	58	98
Norway	97	80	100	92	74	100
New Zealand	98	92	100	93	83	100
Portugal	94	85	99	90	73	98
Scotland	89	73	98	78	56	97
Singapore	97	92	100	94	87	99
United States	98	92	100	93	82	100
AVERAGE	94	83	99	87	72	98

*Based on 23 science items, including 4 multiple-part items.
Note: Percent agreement was computed separately for each part, and each part was treated as a separate item in computing averages and ranges.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Test Reliability

Table A.10 displays the science test reliability coefficient for each country for the lower and upper grades (usually third and fourth grades). This coefficient is the median KR-20 reliability across the eight test booklets. Median reliabilities in the lower grade ranged from .67 to .85 and in the upper grade from .70 to .83. The international median, shown in the last row of the table, is the median of the reliability coefficients for all countries. These international medians are .78 for the lower grade and .77 for the upper grade.

Data Processing

To ensure the availability of comparable, high-quality data for analysis, TIMSS engaged in a rigorous set of quality control steps to create the international database.[13] TIMSS prepared manuals and software for countries to use in entering their data so that the information would be in a standardized international format before being forwarded to the IEA Data Processing Center in Hamburg for creation of the international database. Upon arrival at the IEA Data Processing Center, the data from each country underwent an exhaustive cleaning process. The data-cleaning process involved several iterative steps and procedures designed to identify, document, and correct deviations from the international instruments, file structures, and coding schemes. This process also emphasized consistency of information within national data sets and appropriate linking among the many student, teacher, and school data files.

Throughout the process, the data were checked and double-checked by the IEA Data Processing Center, the International Study Center, and the national centers. The national centers were contacted regularly and given multiple opportunities to review the data for their countries. In conjunction with the Australian Council for Educational Research (ACER), the International Study Center conducted a review of item statistics for each of the cognitive items in each of the countries to identify poorly performing items. Six countries had one or more science items deleted (in most cases, one). Usually the poor statistics (negative point-biserials for the key, large item-by-country interactions, and statistics indicating lack of fit with the model) were a result of translation, adaptation, or printing deviations.

[13] These steps are detailed in Gonzalez, E. and Smith, T. (1996). Data Consistency Checking Across Countries. In M.O. Martin and D.L. Kelly (Eds.), Third International Mathematics and Science Study Technical Report Volume I. Chestnut Hill, MA: Boston College.

Table A.10

Cronbach's Alpha Reliability Coefficients[1]
TIMSS Science Test
Lower and Upper Grades (Third and Fourth Grades*)

Country	Lower Grade	Upper Grade
Australia	0.84	0.80
Austria	0.81	0.74
Canada	0.78	0.80
Cyprus	0.71	0.73
Czech Republic	0.78	0.78
England	0.85	0.82
Greece	0.79	0.77
Hong Kong	0.74	0.75
Hungary	0.79	0.76
Iceland	0.76	0.78
Iran, Islamic Rep.	0.71	0.70
Ireland	0.80	0.77
Israel	-	0.76
Japan	0.73	0.70
Korea	0.70	0.71
Kuwait	-	0.74
Latvia (LSS)	0.78	0.75
Netherlands	0.67	0.70
New Zealand	0.84	0.83
Norway	0.81	0.79
Portugal	0.82	0.78
Scotland	0.83	0.82
Singapore	0.82	0.83
Slovenia	0.78	0.74
Thailand	0.76	0.75
United States	0.82	0.82
International Median	0.78	0.77

*Third and fourth grades in most countries; see Table 2 for more information about the grades tested in each country.
[1]The reliability coefficient for each country is the median KR-20 reliability across the eight test booklets. The international median is the median of the reliability coefficients for all countries.
A dash (-) indicates data are unavailable. Israel and Kuwait did not test the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

IRT Scaling and Data Analysis

Two general analysis approaches were used for this report – item response theory scaling methods and average percent correct technology. The overall science results were summarized using an item response theory (IRT) scaling method (Rasch model). This scaling method produces a science score by averaging the responses of each student to the items that student took in a way that takes into account the difficulty of each item. The method used in TIMSS includes refinements that enable reliable scores to be produced even though individual students responded to relatively small subsets of the total science item pool. Analyses of the response patterns of students from participating countries indicated that, although the items in the test address a wide range of science content, the performance of the students across the items was sufficiently consistent to be usefully summarized in a single science score.

An IRT approach was preferred for developing comparable estimates of performance for all students, since students answered different test items depending upon which of the eight test booklets they received. The IRT analysis provides a common scale on which performance can be compared across countries. In addition to providing a basis for estimating mean achievement, scale scores permit estimates of how students within countries vary and provide information on percentiles of performance. The scale was standardized using students from both the grades tested. When all participating countries and grades are treated equally, the TIMSS scale average is 500 and the standard deviation is 100. Since the countries varied in size, each country was reweighted to contribute equally to the mean and standard deviation of the scale. The average of the scale scores was constructed to be the average of the 26 means of participants that were available at the fourth grade and the 24 means at the third grade. The average and standard deviation of the scale scores are arbitrary and do not affect scale interpretations.

The analytic approach underlying the results in Chapters 2 and 3 of this report involved calculating the percentage of correct answers for each item for each participating country (as well as the percentages of different types of incorrect responses). The percentage of correct responses were averaged to summarize science performance overall and in each of the content areas for each country as a whole and by gender. For items with more than one part, each part was analyzed separately in calculating the percentage of correct responses. Also, for items with more than one point awarded for full credit, the percentage of correct responses reflect an average of the points received by students in each country. This was achieved by including the percentage of students receiving one score point as well as the percentage receiving two score points in the calculations. Thus, the average percent correct is based on the number of score points rather than the number of items per se. An exception to this is the international average percent correct reported for example items, where the values reflect the percentage of students receiving full credit.

Estimating the Link Between Fourth- and Eighth-Grade Performance

Fifteen of the items in mathematics (15%) and 18 in science (19%) were included in the tests at both Populations 1 and 2. The difference in performance between the populations on these items was used to estimate the link between the third and fourth grades on one hand and the seventh and eighth grades on the other.

For each of the link items, the international item difficulty level from the IRT analyses for Population 1 was subtracted from the international difficulty level at Population 2. Investigations of the results indicated that the increases between the two populations were relatively stable across items, especially in mathematics. It also was determined that between-grade increases between the third and fourth grades and between the seventh and eighth grades on the link items were consistent with the between-grade increases observed on the entire pool of items for Populations 1 and 2, respectively. Thus, the average difference across items was used to estimate the difference in performance between the two populations.

In making the link, results for the third- and fourth-grade students were placed on the scale used to report seventh- and eighth-grade performance. Because of the difference in variances between the scales for Populations 1 and 2, it first was necessary to transform the Population 1 scales. The adjustment factor for mathematics was .96 and for science was 1.25. Next, a constant (121 scale points for mathematics and 283 for science) was subtracted from the Population 1 results for each country.

The country means for the third and fourth grades transformed to the seventh- and eighth-grade scale are shown in Table A.11. The results shown in Table A.11 are based on all items administered to the third and fourth graders. The relative standings of the countries are identical to those presented in Chapter 1. Since there were relatively few items in common, the size of the link is approximate. The standard errors for the third- and fourth-grade estimates incorporate an added component to account for the uncertainty of this approximation. Because the link is very approximate, the achievement increases between the third/fourth grades and the seventh/eighth grades must be interpreted with extreme caution.

Table A.11

Science Performance at the Third, Fourth, Seventh, and Eighth Grades* Based on the Population 2 (Seventh- and Eighth-Grade) Scale

Country	Third Grade Mean	Fourth Grade Mean	Seventh Grade Mean	Eighth Grade Mean
Australia	**351 (14.9)**	**417 (14.4)**	**504 (3.6)**	**545 (3.9)**
Austria	345 (15.0)	420 (14.5)	519 (3.1)	558 (3.7)
Canada	328 (14.2)	401 (14.4)	499 (2.3)	531 (2.6)
Cyprus	233 (14.2)	309 (14.5)	420 (1.8)	463 (1.9)
Czech Republic	332 (14.5)	410 (14.4)	533 (3.3)	574 (4.3)
England	338 (14.5)	404 (14.5)	512 (3.5)	552 (3.3)
Greece	272 (14.7)	336 (14.8)	449 (2.6)	497 (2.2)
Hong Kong	316 (14.5)	381 (14.6)	495 (5.5)	522 (4.7)
Hungary	295 (14.8)	379 (14.5)	518 (3.2)	554 (2.8)
Iceland	259 (14.5)	345 (14.5)	462 (2.8)	494 (4.0)
Iran, Islamic Rep.	160 (14.8)	235 (14.7)	436 (2.6)	470 (2.4)
Ireland	313 (14.6)	389 (14.5)	495 (3.5)	538 (4.5)
Israel	- -	345 (14.6)	- -	524 (5.7)
Japan	367 (14.0)	431 (14.1)	531 (1.9)	571 (1.6)
Korea	405 (14.2)	460 (14.1)	535 (2.1)	565 (1.9)
Kuwait	- -	217 (14.4)	- -	430 (3.7)
Latvia (LSS)	296 (15.0)	355 (15.2)	435 (2.7)	485 (2.7)
Netherlands	338 (14.4)	410 (14.4)	517 (3.6)	560 (5.0)
New Zealand	306 (15.3)	378 (15.2)	481 (3.4)	525 (4.4)
Norway	278 (14.7)	377 (14.6)	483 (2.9)	527 (1.9)
Portugal	244 (14.9)	314 (14.8)	428 (2.1)	480 (2.3)
Scotland	319 (14.9)	384 (14.8)	468 (3.8)	517 (5.1)
Singapore	324 (15.2)	398 (15.2)	545 (6.6)	607 (5.5)
Slovenia	323 (14.3)	396 (14.5)	530 (2.4)	560 (2.5)
Thailand	255 (16.1)	306 (15.2)	493 (3.0)	525 (3.7)
United States	353 (14.4)	421 (14.4)	508 (5.5)	534 (4.7)
International Average	306 (3.0)	370 (2.9)	492 (0.7)	527 (0.7)

*Third, fourth, seventh, and eighth grades in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
A dash (-) indicates data are unavailable. Israel and Kuwait did not test the third or seventh grades.
Note: Since there are only 17 science items in common in the tests given to the two grades, the estimate of the relationship is approximate. The standard errors for the third- and fourth-grade estimates incorporate an added component to account for the uncertainty of this approximation. The seventh- and eighth-grade means are the same as those reported in *Science Achievement in the Middle School Years: IEA's Third Mathematics and Science Study*.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Estimating Sampling Error

Because the statistics presented in this report are estimates of national performance based on samples of students, rather than the values that could be calculated if every student in every country had answered every question, it is important to have measures of the degree of uncertainty of the estimates. The jackknife procedure was used to estimate the standard error associated with each statistic presented in this report. The use of confidence intervals, based on the standard errors, provides a way to make inferences about the population means and proportions in a manner that reflects the uncertainty associated with the sample estimates. An estimated sample statistic plus or minus two standard errors represents a 95% confidence interval for the corresponding population result.

Appendix B

Test-Curriculum Matching Analysis

When comparing student achievement across countries, it is important that the comparisons be as "fair" as possible. TIMSS has worked towards this goal in a number of ways, including providing detailed procedures for standardizing the population definitions, sampling, test translations, test administration, scoring, and database formation. Developing the TIMSS tests involved the interaction of experts in the sciences with representatives of the participating countries and testing specialists.[1] The National Research Coordinators (NRCs) from each country formally approved the TIMSS test, thus accepting it as being sufficiently fair to compare their students' science achievement with that of students from other countries.

Although the TIMSS test was developed to represent a set of agreed-upon science content areas, there are differences among the curricula of participating countries that result in various science topics being taught at different grades. To restrict test items not only to those topics in the curricula of all countries but also to those covered in the same sequence in all participating countries would severely limit test coverage and restrict the research questions about international differences that TIMSS is designed to address. The TIMSS tests, therefore, inevitably contain some items measuring topics unfamiliar to some students in some countries.

The Test-Curriculum Matching Analysis (TCMA) was developed and conducted to investigate the appropriateness of the TIMSS science test for third- and fourth-grade students in the participating countries, and to show how student performance for individual countries varied when based only on the test questions that were judged to be relevant to their own curriculum.[2]

To gather data about the extent to which the TIMSS tests were relevant to the curriculum of the participating countries, TIMSS asked the NRC of each country to report whether or not each item was in their country's intended curriculum at each of the two grades being tested. The NRC was asked to choose a person or persons who were very familiar with the curricula at the grades being tested to make the determination. Since an item might be in the curriculum for some but not all students in a country, an item was determined appropriate if it was in the intended curriculum for more than 50% of the students. The NRCs had considerable flexibility in selecting items and may have considered items inappropriate for other reasons. All participating countries except Austria and Thailand returned the information for analysis.

[1] See Appendix A for more information on the test development.

[2] Because of time constraints, topics covered in some countries may not be covered by the TIMSS tests. The TCMA does not provide complete information about how well the TIMSS tests cover the curriculum of any country.

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Tables B.1 and B.2 present the TCMA results for the fourth and third grades, respectively. The first row of each table indicates that at both grades the countries varied substantially in the number of items considered appropriate. At the fourth grade, half of the countries indicated that items representing two-thirds or more of the score points (70 out of a possible 105) were appropriate,[3] with the percentage ranging from 100% in the United States to approximately 25% in Korea (25 score points) and Japan (29 score points). Fewer items were selected at the third grade, where about one-third of the countries selected at least half of the score points. All items were selected at the third grade as well as the fourth grade in the United States. At the third grade there were also several countries, including Ireland, Korea, and Japan, that retained less than 20% of the score points. That lower percentages of items were selected for the TCMA at the third grade is consistent with the instrument development process, which put more emphasis on the upper-grade curriculum. The low percentage of items considered appropriate for their curricula in several countries implies that science may not be emphasized at these grades by those countries.

Since most countries indicated that some items were not included in their intended curricula at the two grades tested, the question becomes whether the inclusion of these items had any effect on the international performance comparisons.[4] The TCMA results offer a method for answering this question, providing evidence that the relative standings of countries generally do not vary much for the different sets of items selected from the TIMSS science test.

The first column in Tables B.1 and B.2 shows the overall average percent correct for each country (as discussed in Chapter 2 and reproduced here for convenience in making comparisons). The countries are presented in the order of their overall performance, from highest to lowest. To interpret these tables, reading across a row provides the average percent correct for the students in that country on the items selected by each country listed across the top of the table. For example, at the fourth grade Korea, where the average percent correct was 77% on its own set of items, had 79% for the items selected by Japan, 78% for those selected by the Netherlands, 74% for those selected by Australia, and so forth. The column for a country shows how each of the other countries performed on the subset of items selected for its own students. Using the set of items selected by Hong Kong as an example, on average, 81% of these were answered correctly by the Korean students, 76% by the Japanese students, 74% by the Dutch, and so forth. The shaded diagonal elements in each table show how each country performed on the subset of items that it selected based on its own curriculum. Thus, the Hong Kong students themselves averaged 72% correct responses on the items identified by Hong Kong for the analysis.

[3] Of the 87 items in the test, some items were designed more specifically for others (i.e., each of some items had two parts and some extended-response items were scored on a two-point scale). The total number of score points available for analysis was 105. The TCMA used the score points in order to give the same weight to items that had received the full scoring.

[4] It should be noted that the performance levels presented in Tables B.1 and B.2 are based on the average percent correct as was done in Chapter 2, which is different from the average scale scores that were presented in Chapter 1. The conclusions of section 1 would have been comparable for the TCMA analyses.

Table B.1 Test-Curriculum Matching Analysis Results - Science - Upper Grade (Fourth Grade*)

Average Percent Correct Based on Subsets of Items Specially Identified by Each Country as Addressing Its Curriculum (See Table B.3 for corresponding standard errors)

Instructions: Read ***across*** the row to compare that country's performance based on the test items included by each of the countries across the top.
Read ***down*** the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top.
Read along the ***diagonal*** to compare performance for each different country based on its own decisions about the test items to include.

Country	Average Percent Correct on all Items	Korea	Japan	Netherlands	Australia	United States	Czech Republic	Singapore	Slovenia	Canada	England	Hong Kong	Hungary	Ireland	Norway	New Zealand	Scotland	Israel	Latvia (LSS)	Iceland	Greece	Cyprus	Portugal	Iran, Islamic Rep.	Kuwait
	(Number of Score Points Included)																								
	105	25	29	68	80	105	95	52	98	93	53	42	49	27	62	90	45	33	104	94	71	61	84	85	85
Korea	74 (0.4)	**77**	79	78	74	74	75	78	74	75	76	81	78	83	77	76	81	76	74	73	76	78	75	75	75
Japan	70 (0.3)	68	**79**	74	71	70	70	73	70	71	71	76	72	80	73	72	76	71	70	70	72	72	72	72	70
Netherlands	67 (0.5)	65	70	**72**	68	67	67	69	68	67	68	74	69	77	72	68	75	69	67	66	70	71	70	68	68
Australia	66 (0.5)	66	67	70	**68**	66	67	70	67	66	68	73	67	78	70	68	75	67	66	66	69	70	68	67	67
United States	66 (0.5)	65	67	70	67	**66**	66	70	66	66	69	73	67	78	70	67	75	69	66	66	69	69	68	67	67
Czech Republic	65 (0.5)	65	68	70	67	65	**66**	68	66	65	66	72	68	79	70	68	71	67	65	66	68	69	68	67	66
Singapore	64 (0.8)	62	70	69	65	64	65	**71**	64	65	66	74	68	76	68	66	72	65	64	64	67	68	66	66	66
Slovenia	64 (0.7)	61	64	68	64	64	64	66	**64**	64	65	70	65	74	69	66	69	64	64	65	66	67	66	65	64
Canada	64 (0.6)	64	64	67	65	64	64	66	64	**63**	64	71	64	76	67	65	71	65	64	63	66	67	65	64	64
England	63 (0.6)	63	64	67	64	63	63	66	64	63	**65**	71	65	76	68	65	71	64	63	63	66	67	65	64	64
Hong Kong	62 (0.7)	59	68	66	64	62	63	66	63	62	63	**72**	65	76	68	64	67	61	62	62	65	65	64	64	63
Hungary	62 (0.6)	60	62	66	62	62	62	64	63	61	62	69	**65**	73	67	63	66	62	62	62	65	65	63	63	62
Ireland	61 (0.6)	60	61	64	62	61	61	64	61	61	62	69	62	**74**	65	62	69	64	61	61	63	66	63	62	62
Norway	60 (0.6)	58	61	65	61	60	61	63	61	60	61	68	62	71	**67**	62	68	59	61	61	63	64	63	61	61
New Zealand	60 (0.9)	59	60	64	61	60	61	64	61	60	61	67	61	72	64	**62**	68	61	60	60	63	65	62	61	61
Scotland	60 (0.8)	59	61	64	61	60	60	64	61	60	62	69	62	73	65	62	**69**	61	60	60	63	65	62	61	61
Israel	57 (0.8)	56	58	61	57	57	57	61	57	57	59	65	59	69	61	58	65	**58**	57	57	59	60	60	58	57
Latvia (LSS)	56 (0.8)	55	56	60	57	56	56	59	57	56	56	63	59	66	61	58	62	56	**56**	57	58	59	58	58	57
Iceland	55 (0.7)	55	55	59	56	55	56	59	56	55	56	61	58	65	61	57	64	55	55	**56**	57	57	57	57	56
Greece	54 (0.8)	53	54	58	54	54	54	58	54	54	54	62	56	65	59	55	62	55	54	54	**57**	58	56	55	55
Cyprus	51 (0.5)	52	52	55	51	51	50	55	51	50	49	59	53	61	56	52	58	53	50	51	53	**54**	52	52	52
Portugal	50 (0.7)	50	50	54	51	50	50	53	51	49	50	57	52	59	55	52	57	52	50	50	52	53	**53**	51	50
Iran, Islamic Rep.	40 (0.7)	38	39	44	40	40	40	45	40	39	38	48	42	48	44	41	44	37	40	40	42	41	41	**41**	41
Kuwait	39 (0.5)	42	42	43	39	39	40	43	39	38	37	47	41	48	43	41	45	40	39	39	42	41	40	40	**41**
International Average	**60 (0.6)**	**59**	**61**	**64**	**60**	**60**	**60**	**63**	**60**	**60**	**60**	**67**	**62**	**71**	**64**	**61**	**67**	**61**	**60**	**60**	**62**	**63**	**61**	**61**	**60**

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
**Of the 97 items in the science test, some items had two parts and some extended response items were scored on a two point scale, resulting in 105 total score points.
( ) Standard errors for the average percent of correct responses on all items appear in parentheses. Standard errors for scores based on subsets of items are provided in Table B.3.
Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3 for details).
Because population coverage falls below 65% Latvia is annotated LSS for Latvian Speaking Schools only.
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table B.2 Test-Curriculum Matching Analysis Results - Science - Lower Grade (Third Grade*)

Average Percent Correct Based on Subsets of Items Specially Identified by Each Country as Addressing Its Curriculum (See Table B.4 for corresponding standard errors)

Instructions: Read ***across*** the row to compare that country's performance based on the test items included by each of the countries across the top.
Read ***down*** the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top.
Read along the ***diagonal*** to compare performance for each different country based on its own decisions about the test items to include.

Country	*Average Percent Correct on all Items*	**Korea**	**Japan**	*Australia*	**United States**	*Netherlands*	**Czech Republic**	**England**	**Canada**	**Singapore**	*Slovenia*	**Hong Kong**	*Scotland*	**Ireland**	**New Zealand**	*Hungary*	*Latvia (LSS)*	**Norway**	**Greece**	**Iceland**	**Portugal**	**Cyprus**	**Iran, Islamic Rep.**
	(Number of Score Points Included)																						
	105	*11*	*17*	*49*	*105*	*34*	*40*	*32*	*64*	*32*	*92*	*34*	*33*	*14*	*68*	*41*	*74*	*49*	*30*	*93*	*84*	*44*	*39*
Korea	67 (0.5)	**66**	76	71	67	76	78	74	71	71	67	76	77	83	71	74	68	74	78	67	68	70	69
Japan	61 (0.3)	62	**76**	67	61	68	74	68	66	65	61	70	66	77	65	66	61	68	69	61	63	64	64
Australia	57 (0.8)	55	60	**61**	57	62	65	62	61	58	57	65	66	76	59	59	58	64	69	56	58	58	58
United States	56 (0.6)	57	60	62	**56**	62	66	62	61	58	57	66	66	75	58	59	58	66	69	56	58	58	59
Netherlands	56 (0.7)	57	60	61	56	**66**	67	62	60	55	57	67	65	72	58	61	59	66	68	55	58	59	59
Czech Republic	55 (0.6)	52	61	58	55	61	**66**	60	58	56	55	64	63	74	58	59	56	64	70	55	57	56	59
England	55 (0.7)	51	57	59	55	61	64	**60**	58	56	55	64	64	73	57	58	56	63	66	54	56	55	57
Canada	53 (0.5)	52	56	57	53	59	62	58	**57**	54	53	62	62	70	55	56	55	61	65	53	55	54	55
Singapore	53 (0.9)	54	65	58	53	61	66	62	58	**61**	52	65	62	74	56	60	54	61	64	53	55	57	57
Slovenia	53 (0.5)	46	55	55	53	58	65	58	56	54	**53**	62	62	72	54	57	54	62	65	54	55	54	54
Hong Kong	53 (0.6)	53	59	57	53	59	64	60	57	54	52	**63**	61	74	56	56	54	61	62	52	54	52	57
Scotland	51 (0.7)	48	55	56	51	58	62	57	55	53	52	61	**61**	71	53	56	53	60	64	51	53	53	54
Ireland	51 (0.7)	47	54	56	51	58	62	57	56	54	51	62	62	**72**	53	55	53	60	64	51	53	52	54
New Zealand	51 (0.9)	51	54	54	51	57	61	56	54	53	51	60	60	69	**53**	55	52	58	63	50	52	53	53
Hungary	50 (0.8)	44	55	52	50	55	61	55	53	52	51	61	57	67	52	**55**	50	58	65	50	51	52	53
Latvia (LSS)	48 (0.9)	43	50	50	48	54	60	53	51	51	49	58	56	64	51	54	**50**	57	62	49	51	52	52
Norway	46 (0.7)	41	48	49	46	50	56	49	49	45	46	55	55	61	48	49	48	**56**	60	46	48	48	49
Greece	44 (0.7)	35	43	46	44	49	54	48	49	45	45	55	56	63	46	49	46	54	**59**	45	46	46	45
Iceland	42 (0.6)	33	40	44	42	45	51	45	46	42	42	50	52	54	44	46	44	52	56	**43**	44	42	44
Portugal	41 (0.8)	31	45	43	41	45	51	45	44	44	41	51	48	55	43	45	43	50	53	41	**43**	44	44
Cyprus	39 (0.5)	33	43	41	39	45	52	44	43	43	39	50	47	57	42	43	41	48	52	40	41	**44**	40
Iran, Islamic Rep.	30 (0.7)	23	33	31	30	31	39	31	33	33	30	40	33	42	32	33	31	36	39	31	31	33	**34**
International Average	51 (0.7)	**47**	**55**	**54**	**51**	**56**	**61**	**56**	**54**	**53**	**51**	**60**	**59**	**68**	**53**	**55**	**52**	**59**	**63**	**51**	**52**	**53**	**53**

*Third grade in most countries; see Table 2 for more information about the grades tested in each country.
**Of the 97 items in the science test, some items had two parts and some extended-response items were scored on a two-scale, resulting in 105 total score points.
( ) Standard errors for the average percent of correct responses on all items appear in parentheses. Standard errors for scores based on subsets of items are provided in Table B.4.
Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3 for details).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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The international averages of each country's selected items presented across the last row of the tables show that the selection of items for the participating countries varied somewhat in average difficulty, ranging from 59% to 71% at the fourth grade and from 47% to 61% at third grade. Despite these differences, the overall picture provided by Tables B.1 and B.2 reveals that different item selections do not make a major difference in how well countries perform relative to each other. The items selected by some countries were more difficult than those selected by others. The relative performance of countries on the various item selections did vary somewhat, but generally not in a statistically significant manner.

Comparing the diagonal element for a country with the overall average percentage correct shows the difference between performance on this subset of items and performance on the test as a whole. In general, there were small increases in each country's performance on its own subset of items. To illustrate, the average percent correct for fourth-grade students in Korea was 74%. The diagonal element shows that Korean students had about the same average percent correct (77%) on the smaller set of items selected as relevant to the curriculum in Korea as they did overall. In the fourth grade, most countries had a difference of less than 5 percentage points between the two performance measures, with the largest difference of 13% for Ireland (74% compared to 61%). Performance differences between the entire TIMSS test and the subset of items selected for the TCMA were, in general, somewhat larger for third-grade students; several countries had an average performance that was 10 percentage points or more higher on the subsets of items selected for their own students – Japan, the Netherlands, the Czech Republic, Hong Kong, Scotland, Ireland, Norway, and Greece.

It is clear that the selection of items does not have a major effect on the general relationship among countries. Countries that had substantially higher or lower performance on the overall test in comparison to each other also had higher or lower relative performance on the different sets of items selected for the TCMA. For example, at the fourth grade, Korea had the highest average percent correct on the test as a whole and on all of the item selections, with Japan, the Netherlands, and Australia among the four highest-performing countries in almost all cases. Although there are some changes in the ordering of countries based on the items selected for the TCMA, most of these differences are within the boundaries of sampling error.

As the most extreme example, consider the 27 score points selected by Ireland for the fourth grade. The Irish students did substantially better on these items than on the test as a whole, with 74% correct responses to these items, on average, compared to 61% average correct on the items on the test as a whole. However, all other countries also did better on these particular items, with an international average of 71% for the items selected by Ireland compared with 60% on the test as a whole. Insofar as countries

rejected items that would be difficult for their own students, these items tended to be difficult for students in other countries as well. The analysis shows that omitting such items tends to improve the results for that country, but also tends to improve the results for all other countries, so that the relative standing of countries is largely unaffected.

Table B.3 Standard Errors for the Test-Curriculum Matching Analysis Results - Science - Upper Grade (Fourth Grade*)

See Table B.1 for the Test-Curriculum Matching Analysis Results

Instructions: Read ***across*** the row for the standard error for the score based on the test items included by each of the countries across the top.
Read ***down*** the column under a country name for the standard error for the score of the country down the left on the items included by the country listed on the top.
Read along the ***diagonal*** for the standard error for the score for each different country based on its own decisions about the test items to include.

Country	*Average Percent Correct on all items*	Korea	Japan	*Netherlands*	*Australia*	United States	Czech Republic	Singapore	*Slovenia*	Canada	England	Hong Kong	*Hungary*	Ireland	Norway	New Zealand	Scotland	*Israel*	*Latvia (LSS)*	Iceland	Greece	Cyprus	Portugal	Iran, Islamic Rep.	*Kuwait*
	(Number of Score Points Included)																								
	105	*25*	*29*	*68*	*80*	*105*	*95*	*52*	*98*	*93*	*53*	*42*	*49*	*27*	*62*	*90*	*45*	*33*	*104*	*94*	*71*	*61*	*84*	*85*	*85*
Korea	74 (0.4)	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Japan	70 (0.3)	0.4	0.4	0.3	0.4	0.3	0.3	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.4
Netherlands	67 (0.5)	0.7	0.7	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.5
Australia	66 (0.5)	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
United States	66 (0.5)	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Czech Republic	65 (0.5)	0.7	0.7	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.5
Singapore	64 (0.8)	0.9	0.9	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.8	0.8	0.8	0.9	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9
Slovenia	64 (0.7)	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.7
Canada	64 (0.6)	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.6
England	63 (0.6)	0.8	0.8	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Hong Kong	62 (0.7)	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7
Hungary	62 (0.6)	0.8	0.8	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6
Ireland	61 (0.6)	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Norway	60 (0.6)	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6
New Zealand	60 (0.9)	1.1	1.0	0.9	0.9	0.9	0.9	1.0	0.9	0.9	1.0	0.9	1.0	1.0	0.9	0.9	1.1	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9
Scotland	60 (0.8)	0.9	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Israel	57 (0.8)	1.0	1.1	0.8	0.8	0.8	0.8	1.0	0.8	0.9	1.0	0.9	0.9	0.9	0.8	0.8	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Latvia (LSS)	56 (0.8)	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.9	0.9	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.8
Iceland	55 (0.7)	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.8	0.8	0.8	0.7	0.7	0.8	0.8	0.7	0.7	0.8	0.8	0.7	0.7	0.7
Greece	54 (0.8)	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.9	0.8	0.9	0.9	0.9	0.8	0.8	0.9	0.9	0.8	0.9	0.8
Cyprus	51 (0.5)	0.6	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.5	0.5
Portugal	50 (0.7)	0.9	1.0	0.8	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.7	0.8	0.9	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.7
Iran, Islamic Rep.	40 (0.7)	0.7	0.9	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.8	0.7	0.9	0.8	0.7	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Kuwait	39 (0.5)	0.5	0.6	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.6	0.8	0.6	0.6	0.7	0.6	0.5	0.5	0.6	0.6	0.6	0.5	0.6
International Average	60 (0.6)	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.6

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.

**Of the 97 items in the science test, some items had two parts and some extended response items were scored on a two point scale, resulting in 105 total score points.

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. The matrix contains standard errors corresponding to the average percent of correct responses based on TCMA subsets of items, as displayed in Table B.1. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age grade specifications, or classroom sampling procedures (see Figure A.3 for details).

Because population coverage falls below 65% Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table B.4 Standard Errors for the Test-Curriculum Matching Analysis Results - Science - Lower Grade (Third Grade*)

See Table B.3 for the Test-Curriculum Matching Analysis Results

Instructions Read ***across*** the row for the standard error for the score based on the test items included by each of the countries across the top.
Read ***down*** the column under a country name for the standard error for the score of the country down the left on the items included by the country listed on the top.
Read along the ***diagonal*** for the standard error for the score for each different country based on its own decisions about the test items to include.

Country	Average Percent Correct on all items	Korea	Japan	Australia	United States	Netherlands	Czech Republic	England	Canada	Singapore	Slovenia	Hong Kong	Scotland	Ireland	New Zealand	Hungary	Latvia (LSS)	Norway	Greece	Iceland	Portugal	Cyprus	Iran, Islamic Rep.
	(Number of Score Points Included)																						
	105	11	17	49	105	34	40	32	64	32	92	34	33	14	68	41	74	49	30	93	84	44	39
Korea	67 (0.5)	**0.8**	0.6	0.5	0.5	0.5	0.4	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Japan	61 (0.3)	0.5	**0.5**	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Australia	57 (0.8)	0.9	1.0	**0.8**	0.8	0.8	0.7	0.8	0.7	0.7	0.7	0.8	0.9	0.8	0.8	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7
United States	56 (0.6)	1.1	0.8	0.6	**0.6**	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.7	0.6
Netherlands	56 (0.7)	1.0	0.8	0.8	0.7	**0.8**	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8
Czech Republic	55 (0.6)	0.9	0.7	0.6	0.6	0.7	**0.6**	0.7	0.6	0.7	0.6	0.6	0.6	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
England	55 (0.7)	0.9	1.0	0.7	0.7	0.7	0.6	**0.7**	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.8
Canada	53 (0.5)	0.8	0.7	0.6	0.5	0.5	0.5	0.6	**0.5**	0.7	0.5	0.6	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.6
Singapore	53 (0.9)	0.8	0.9	1.0	0.9	0.9	0.9	0.9	0.9	**0.9**	0.9	0.9	1.0	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.8	0.9
Slovenia	53 (0.5)	1.0	0.7	0.6	0.5	0.6	0.6	0.6	0.6	0.6	**0.6**	0.5	0.7	0.7	0.5	0.6	0.5	0.5	0.7	0.5	0.5	0.5	0.7
Hong Kong	53 (0.6)	0.8	0.7	0.6	0.6	0.8	0.7	0.6	0.7	0.7	0.6	**0.5**	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6
Scotland	51 (0.7)	1.1	0.9	0.8	0.7	0.9	0.8	0.8	0.8	0.9	0.8	0.7	**0.8**	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.8	0.8
Ireland	51 (0.7)	1.0	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	**0.9**	0.7	0.7	0.6	0.7	0.8	0.6	0.7	0.7	0.8
New Zealand	51 (0.9)	1.4	1.1	1.0	0.9	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.1	1.1	**0.9**	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0
Hungary	50 (0.8)	1.1	0.9	0.9	0.8	1.0	0.8	0.9	0.9	0.9	0.8	0.8	0.8	1.0	0.8	**0.8**	0.8	0.9	0.8	0.8	0.8	0.8	0.8
Latvia (LSS)	48 (0.9)	1.2	1.0	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	**0.9**	0.9	0.9	0.9	0.8	0.9	0.9
Norway	46 (0.7)	1.0	0.9	0.8	0.7	0.9	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.9	0.7	0.8	0.7	**0.8**	0.7	0.7	0.7	0.7	0.8
Greece	44 (0.7)	1.3	1.2	0.8	0.7	1.0	0.9	1.1	0.8	0.9	0.8	0.9	0.8	1.0	0.8	0.9	0.8	0.8	**0.9**	0.7	0.7	0.9	0.7
Iceland	42 (0.6)	1.1	1.1	0.7	0.6	0.8	0.8	0.8	0.6	0.8	0.6	0.7	0.9	0.8	0.7	0.8	0.7	0.7	0.8	**0.6**	0.7	0.8	0.7
Portugal	41 (0.8)	1.1	1.0	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	1.0	0.8	0.8	0.8	0.8	0.8	0.8	**0.8**	0.8	0.8
Cyprus	39 (0.5)	1.0	0.8	0.5	0.5	0.7	0.6	0.6	0.6	0.6	0.5	0.6	0.7	0.8	0.6	0.7	0.5	0.6	0.6	0.5	0.5	**0.6**	0.6
Iran, Islamic Rep.	30 (0.7)	1.0	0.8	0.7	0.7	0.8	0.9	0.8	0.8	0.8	0.7	0.9	0.8	0.9	0.7	0.8	0.7	0.8	0.9	0.7	0.7	0.7	**0.8**
International Average	51 (0.7)	1.0	0.9	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

*Third grade in most countries. See Table 2 for more information about the grades tested in each country.
**Of the 97 items in the science test, some items had two parts and some extended-response items were scored on a two-point scale, resulting in 105 total score points.
Standard errors for the average percent of correct responses on all items appear in parentheses. The matrix contains standard errors corresponding to the average percent of correct responses based on TCMA subsets of items, as displayed in Table B.2. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3 for details).
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Appendix C

Percentiles and Standard Deviations of Achievement in Science

Table C.1

Percentiles of Achievement in Science
Upper Grade (Fourth Grade*)

Country	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Australia	403 (6.0)	502 (3.4)	568 (2.7)	626 (2.5)	707 (1.1)
Austria	429 (15.6)	513 (2.6)	568 (1.9)	619 (2.9)	692 (7.0)
Canada	409 (6.1)	493 (4.3)	552 (3.5)	607 (3.6)	691 (3.8)
Cyprus	348 (7.1)	427 (3.1)	476 (2.1)	528 (4.6)	595 (5.1)
Czech Republic	425 (3.9)	502 (3.2)	556 (3.8)	610 (3.8)	689 (2.9)
England	388 (7.8)	489 (3.3)	553 (4.4)	615 (2.8)	708 (8.6)
Greece	354 (8.5)	448 (4.0)	501 (4.0)	552 (5.1)	627 (4.0)
Hong Kong	401 (10.7)	483 (5.5)	536 (4.8)	585 (4.5)	657 (6.0)
Hungary	396 (6.4)	478 (3.5)	535 (3.3)	586 (5.8)	660 (6.9)
Iceland	360 (1.5)	447 (3.5)	507 (4.8)	564 (3.4)	632 (1.9)
Iran, Islamic Rep.	295 (4.0)	365 (3.9)	415 (3.1)	467 (5.5)	539 (4.1)
Ireland	388 (6.7)	487 (7.0)	544 (2.6)	596 (3.6)	674 (5.3)
Israel	366 (8.4)	446 (4.4)	506 (3.6)	564 (3.6)	646 (6.9)
Japan	453 (1.8)	527 (1.9)	576 (2.3)	624 (1.5)	687 (1.6)
Korea	481 (3.0)	554 (3.3)	600 (2.6)	643 (1.6)	704 (3.2)
Kuwait	260 (6.2)	345 (4.2)	401 (2.8)	458 (2.9)	541 (2.1)
Latvia (LSS)	378 (6.0)	457 (6.4)	510 (6.2)	563 (7.0)	649 (11.9)
Netherlands	448 (6.7)	514 (3.4)	556 (3.6)	602 (2.3)	661 (1.8)
New Zealand	364 (9.4)	471 (6.2)	534 (5.3)	598 (4.2)	683 (3.9)
Norway	387 (3.6)	476 (2.8)	534 (3.8)	592 (3.7)	663 (3.7)
Portugal	331 (6.7)	427 (3.6)	485 (3.6)	535 (3.8)	610 (3.6)
Scotland	376 (11.8)	472 (5.2)	540 (4.1)	598 (3.4)	687 (7.9)
Singapore	377 (6.0)	486 (4.3)	551 (6.9)	612 (7.6)	700 (7.8)
Slovenia	419 (7.6)	497 (4.5)	547 (4.0)	598 (2.5)	668 (9.3)
Thailand	353 (9.0)	424 (6.4)	474 (4.7)	520 (3.7)	589 (5.1)
United States	397 (5.7)	505 (5.0)	573 (4.0)	633 (3.1)	711 (4.3)

*Fourth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table C.2

Percentiles of Achievement in Science
Lower Grade (Third Grade*)

Country	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Australia	338 (9.8)	449 (5.5)	513 (4.6)	580 (5.7)	661 (4.9)
Austria	351 (6.9)	449 (6.4)	511 (4.7)	564 (5.8)	640 (5.6)
Canada	339 (7.4)	433 (4.7)	494 (2.4)	552 (2.4)	630 (3.7)
Cyprus	297 (4.2)	365 (4.1)	415 (2.0)	463 (2.5)	534 (4.2)
Czech Republic	355 (6.5)	434 (4.3)	493 (4.3)	553 (3.5)	635 (8.0)
England	328 (6.9)	435 (4.1)	501 (4.3)	568 (3.4)	662 (6.2)
Greece	305 (8.2)	392 (4.2)	447 (3.6)	501 (4.2)	575 (11.4)
Hong Kong	358 (3.1)	432 (4.0)	485 (2.6)	533 (4.4)	598 (5.3)
Hungary	316 (9.4)	406 (5.8)	468 (6.7)	526 (4.0)	606 (11.5)
Iceland	294 (4.2)	381 (4.2)	439 (4.0)	492 (2.8)	566 (2.2)
Iran, Islamic Rep	232 (6.6)	303 (3.4)	357 (5.4)	407 (6.4)	479 (7.5)
Ireland	325 (10.5)	424 (6.0)	482 (3.5)	538 (5.0)	616 (4.0)
Israel	- -	- -	- -	- -	- -
Japan	399 (2.4)	476 (1.6)	524 (2.4)	571 (2.6)	637 (2.7)
Korea	432 (4.2)	507 (2.8)	556 (2.9)	600 (2.0)	667 (4.1)
Kuwait	- -	- -	- -	- -	- -
Latvia (LSS)	328 (6.7)	412 (3.8)	464 (4.0)	520 (6.8)	597 (10.0)
Netherlands	395 (4.2)	460 (4.0)	500 (2.2)	540 (2.3)	599 (3.6)
New Zealand	301 (18.9)	410 (5.3)	478 (6.4)	541 (4.8)	632 (5.2)
Norway	297 (5.3)	390 (3.2)	451 (2.8)	514 (4.0)	592 (6.6)
Portugal	253 (23.8)	366 (5.5)	428 (3.8)	486 (4.1)	574 (6.7)
Scotland	324 (7.1)	423 (4.4)	486 (7.5)	549 (4.8)	635 (7.0)
Singapore	320 (5.2)	421 (6.8)	489 (6.5)	556 (5.1)	647 (7.2)
Slovenia	357 (6.3)	435 (2.2)	487 (2.9)	541 (2.9)	617 (7.3)
Thailand	304 (8.6)	382 (8.9)	434 (4.9)	486 (9.1)	555 (10.8)
United States	352 (5.3)	450 (4.3)	515 (4.5)	575 (3.4)	662 (12.0)

*Third grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses.
A dash (-) indicates data are not available. Israel and Kuwait did not test the lower grades.
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table C.3

Standard Deviations of Achievement in the Sciences
Upper Grade (Fourth Grade*)

Country	Overall		Boys		Girls	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Australia	562 (2.9)	93 (1.9)	569 (3.3)	97 (2.2)	556 (3.2)	88 (2.0)
Austria	565 (3.3)	80 (2.0)	572 (3.9)	80 (2.5)	556 (3.7)	79 (2.2)
Canada	549 (3.0)	86 (1.8)	553 (3.7)	89 (2.1)	545 (3.2)	82 (2.2)
Cyprus	475 (3.3)	76 (1.5)	480 (4.0)	79 (2.1)	471 (3.1)	72 (1.4)
Czech Republic	557 (3.1)	81 (1.5)	565 (3.4)	81 (1.8)	548 (3.6)	81 (1.9)
England	551 (3.3)	96 (1.6)	555 (4.0)	102 (2.3)	548 (3.4)	90 (1.9)
Greece	497 (4.1)	83 (3.3)	501 (4.5)	84 (3.4)	494 (4.3)	82 (3.7)
Hong Kong	533 (3.7)	78 (1.7)	540 (4.1)	80 (2.0)	526 (3.8)	73 (2.2)
Hungary	532 (3.4)	81 (1.3)	539 (3.8)	81 (1.9)	525 (3.9)	79 (1.8)
Iceland	505 (3.3)	85 (1.5)	514 (4.3)	88 (2.2)	496 (3.3)	81 (2.0)
Iran, Islamic Rep	416 (3.9)	74 (1.7)	421 (5.9)	76 (2.5)	412 (4.7)	72 (1.8)
Ireland	539 (3.3)	85 (1.7)	543 (3.5)	87 (1.9)	536 (4.5)	82 (2.2)
Israel	505 (3.6)	86 (1.5)	512 (4.5)	87 (2.0)	501 (3.8)	86 (2.0)
Japan	574 (1.8)	73 (1.0)	580 (2.0)	77 (1.5)	567 (2.0)	68 (1.0)
Korea	597 (1.9)	68 (0.9)	604 (2.2)	70 (1.5)	590 (2.5)	66 (1.3)
Kuwait	401 (3.1)	85 (1.8)	389 (5.8)	92 (2.4)	414 (3.1)	75 (1.5)
Latvia (LSS)	512 (4.9)	84 (3.6)	512 (5.4)	87 (4.8)	513 (5.5)	80 (3.2)
Netherlands	557 (3.1)	66 (1.7)	570 (3.6)	65 (2.2)	544 (3.5)	64 (2.2)
New Zealand	531 (4.9)	97 (3.1)	527 (6.1)	104 (3.8)	535 (4.8)	89 (2.9)
Norway	530 (3.6)	86 (1.8)	534 (4.7)	90 (2.7)	526 (3.7)	82 (1.7)
Portugal	480 (4.0)	84 (2.4)	481 (4.5)	87 (2.5)	478 (4.2)	81 (3.2)
Scotland	536 (4.2)	93 (1.7)	538 (4.5)	98 (2.2)	533 (4.3)	89 (2.0)
Singapore	547 (5.0)	97 (2.0)	549 (5.4)	101 (2.2)	545 (6.3)	93 (2.5)
Slovenia	546 (3.3)	76 (1.7)	548 (3.3)	78 (1.9)	544 (4.0)	75 (2.2)
Thailand	473 (4.9)	71 (2.4)	471 (5.9)	73 (3.2)	474 (4.3)	69 (2.1)
United States	565 (3.1)	95 (1.4)	571 (3.3)	97 (1.9)	560 (3.3)	92 (1.5)

*Fourth grade in most countries. See Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95

Table C.4

Standard Deviations of Achievement in the Sciences
Lower Grade (Third Grade*)

Country	Overall		Boys		Girls	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Australia	510 (4.3)	98 (2.1)	510 (5.6)	104 (3.4)	510 (4.3)	92 (1.5)
Austria	505 (4.6)	88 (2.7)	508 (6.9)	92 (4.0)	501 (4.0)	83 (2.2)
Canada	490 (2.5)	88 (1.3)	496 (3.2)	91 (1.9)	486 (2.9)	84 (1.4)
Cyprus	415 (2.5)	73 (1.5)	418 (2.7)	75 (1.7)	412 (3.0)	71 (2.0)
Czech Republic	494 (3.4)	85 (1.4)	503 (4.1)	86 (1.7)	485 (3.9)	82 (1.9)
England	499 (3.5)	101 (1.9)	503 (4.8)	106 (2.4)	495 (3.4)	95 (2.3)
Greece	446 (3.9)	82 (2.6)	453 (4.6)	85 (3.2)	439 (3.9)	79 (2.3)
Hong Kong	482 (3.3)	74 (1.5)	488 (3.4)	75 (1.9)	473 (3.8)	71 (1.6)
Hungary	464 (4.1)	89 (1.7)	472 (4.2)	89 (2.1)	460 (4.7)	88 (2.0)
Iceland	435 (3.3)	82 (1.7)	440 (4.0)	85 (2.6)	431 (3.9)	79 (2.0)
Iran, Islamic Rep	356 (4.2)	76 (2.5)	359 (5.7)	79 (3.0)	354 (5.7)	73 (3.2)
Ireland	479 (3.7)	88 (1.8)	481 (4.6)	91 (2.1)	477 (4.4)	84 (2.4)
Israel	. .	. .	. .	. .	. .	. .
Japan	522 (1.6)	73 (0.8)	523 (2.1)	74 (1.3)	521 (2.0)	71 (1.2)
Korea	553 (2.4)	71 (1.2)	562 (2.8)	73 (1.6)	543 (2.7)	69 (1.4)
Kuwait	. .	. .	. .	. .	. .	. .
Latvia (LSS)	465 (4.5)	83 (3.6)	462 (5.2)	83 (4.3)	469 (4.8)	82 (3.3)
Netherlands	499 (3.2)	63 (2.2)	504 (3.8)	63 (2.7)	493 (3.1)	63 (2.1)
New Zealand	473 (5.2)	100 (2.9)	470 (5.9)	103 (3.7)	476 (5.7)	96 (3.6)
Norway	450 (3.9)	90 (2.0)	457 (4.6)	91 (2.4)	444 (4.5)	88 (2.4)
Portugal	423 (4.3)	96 (2.8)	431 (4.3)	96 (3.1)	415 (5.4)	94 (4.2)
Scotland	484 (4.2)	95 (2.4)	485 (4.4)	94 (2.4)	482 (4.7)	96 (3.1)
Singapore	488 (5.0)	99 (2.0)	491 (5.8)	104 (2.3)	484 (5.2)	93 (2.2)
Slovenia	487 (2.8)	78 (1.2)	496 (3.4)	80 (1.8)	478 (3.4)	75 (2.0)
Thailand	433 (6.6)	78 (4.2)	428 (6.5)	79 (4.2)	437 (7.1)	76 (4.6)
United States	511 (3.2)	94 (2.1)	514 (4.2)	97 (2.6)	508 (3.2)	90 (2.2)

*Third grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses.
A dash (-) indicates data are not available. Israel and Kuwait did not test the lower grades.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Appendix D

Acknowledgments

TIMSS was truly a collaborative effort among hundreds of individuals around the world. Staff from the national research centers, the international management, advisors, and funding agencies worked closely to design and implement the most ambitious study of international comparative achievement ever undertaken. TIMSS would not have been possible without the tireless efforts of all involved. Below, the individuals and organizations are acknowledged for their contributions. Given that implementing TIMSS has spanned more than seven years and involved so many people and organizations, this list may not pay heed to all who contributed throughout the life of the project. Any omission is inadvertent. TIMSS also acknowledges the students, teachers, and school principals who contributed their time and effort to the study. This report would not be possible without them.

MANAGEMENT AND OPERATIONS

Since 1993, TIMSS has been directed by the International Study Center at Boston College in the United States. Prior to this, the study was coordinated by the International Coordinating Center at the University of British Columbia in Canada. Although the study was directed centrally by the International Study Center and its staff members implemented various parts of TIMSS, important activities also were carried out in centers around the world. The data were processed centrally by the IEA Data Processing Center in Hamburg, Germany. Statistics Canada was responsible for collecting and evaluating the sampling documentation from each country and for calculating the sampling weights. The Australian Council for Educational Research conducted the scaling of the achievement data.

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Funding for the International Study Center was provided by the National Center for Education Statistics of the U.S. Department of Education, the U.S. National Science Foundation, and the International Association for the Evaluation for Educational Achievement. Eugene Owen and Lois Peak of the National Center for Education Statistics and Larry Suter of the National Science Foundation each played a crucial role in making TIMSS possible and for ensuring the quality of the study. Funding for the International Coordinating Center was provided by the Applied Research Branch of the Strategic Policy Group of the Canadian Ministry of Human Resources Development. This initial source of funding was vital to initiate the TIMSS project. Tjeerd Plomp, Chair of the IEA and of the TIMSS Steering Committee, has been a constant source of support throughout TIMSS. It should be noted that each country provided its own funding for the implementation of the study at the national level.

NATIONAL RESEARCH COORDINATORS

The TIMSS National Research Coordinators and their staff had the enormous task of implementing the TIMSS design in their countries. This required obtaining funding for the project; participating in the development of the instruments and procedures; conducting field tests; participating in and conducting training sessions; translating the instruments and procedural manuals into the local language; selecting the sample of schools and students; working with the schools to arrange for the testing; arranging for data collection, coding, and data entry; preparing the data files for submission to the IEA Data Processing Center; contributing to the development of the international reports; and preparing national reports. The way in which the national centers operated and the resources that were available varied considerably across the TIMSS countries. In some countries, the tasks were conducted centrally, while in others, various components were subcontracted to other organizations. In some countries, resources were more than adequate, while in others, the national centers were operating with limited resources. Of course, across the life of the project, some NRCs have changed. This list attempts to include all past NRCs who served for a significant period of time as well as all the present NRCs. All of the TIMSS National Research Coordinators and their staff members are to be commended for their professionalism and their dedication in conducting all aspects of TIMSS.

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The International Study Center was supported in its work by several advisory committees. The International Steering Committee provided guidance to the International Study Director on policy issues and general direction of the study. The TIMSS Technical Advisory Committee provided guidance on issues related to design, sampling, instrument construction, analysis, and reporting, ensuring that the TIMSS methodologies and procedures were technically sound. The Subject Matter Advisory Committee ensured that current thinking in mathematics and science education were addressed by TIMSS, and was instrumental in the development of the TIMSS tests. The Free-Response Item Coding Committee developed the coding rubrics for the free-response items. The Performance Assessment Committee worked with the Performance Assessment Coordinator to develop the TIMSS performance assessment. The Quality Assurance Committee helped to develop the quality assurance program.

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